BEST BUYS RADIO GUIDE

19 systems under $250

# MODEL Airplane NEWS

## NEW FOR 2000

21st century RC trends

HOW TO:

- Make scale rivets
- Carbon-fiber mini undercarriage
- Kyosho Stearman electric conversion
- Small airframe aerodynamics

HANGAR 9

**PT-19 ARF**

IMAA-Legal

February 2000

www.modelairplanenews.com

USA $4.95 CANADA $5.95

02>

0 09128 48120 3

GREAT PLANES

**SLOWPOKE**

BALL-PARK BARNSTORMER

# The year of the ARF

One of the most exciting things about being an editor at *Model Airplane News* is that it gives one the opportunity to attend trade shows and see the hottest new RC products before they hit hobby-store shelves. At the 1999 Radio Control Hobby Trade Association (RCHTA) show in Chicago, enthusiasm and spirits were high. It looks as though 2000 will be a very good year for the industry—and an especially good one for us RC modelers! See our special "New for 2000/Air Scoop" column that highlights many of the new products we can look forward to this year. "ARF" was the buzzword at the most recent RCHTA show; nearly all of the model airplane companies represented had a new ARF model (or two—or three!) to show off. These low-assembly-time aircraft are no longer synonymous with trainers, and they are now appearing in every aspect of the hobby, from tiny electric sport models to sailplanes to giant-scale, gas-powered aerobats! The quality and sophistication of these ARFs continue to improve and, as more than one modeler has noted, it would be hard to scratch-build an equivalent plane. ARFs are also becoming much more affordable. One new company, Airborne Models, introduced the first ARF models that we've seen with factory-installed retracts.

***Carl Goldberg's classic Ultimate design was unveiled in ARF form at the '99 RCHTA show.***

Another high-quality, attractive ARF that has already taken flying fields by storm is the Hangar 9 Ultra Series PT-19. This IMAA-legal model is well-built and serves as a great introduction to the popular—and growing—world of giant-scale warbirds. Chris Chianelli reviews the PT-19 on page 42 in this issue.

Today's ARF models are not limited to glow and/or gas powerplants, either; the Kyosho Super Stearman ARF is such a sound design that it can easily be adapted to electric power and still have exciting performance. On page 52, electrics guru Tom Hunt shares the simple modifications he made to the model to convert it to electric power. Tom videotaped the model in flight (check out video clips at www.modelairplanenews.com), and all of the editors were very impressed with the Stearman's aerobatic capabilities on e-power.

On the smaller end of the spectrum, Hitec RCD recently introduced its new, much-anticipated Feather receiver. Weighing in at only 7 grams (¼ ounce!), this 4-channel FM unit is less than 1½ inches long and is ¾ inch wide. This micro receiver is sure to be a hit with backyard fliers, and *Model Airplane News* contributor Bob Aberle tests it and provides a report card on its performance on page 60.

Are you looking for a radio system that's loaded with features yet won't break the bank? Check out this month's survey of budget radios. Never before have so much versatility and reliability been available for such a small price tag. For less than $250, you can buy a radio system that features simple setup, nearly unlimited mixing capabilities, model memory functions and more. In our survey, you'll find detailed information on 19 of the most popular radio systems available. Read before you buy so you'll be certain to get the most value for your modeling dollar. ✈


***The RCHTA show was brightened up by Hobbico's new Spectrum ARF, which certainly lives up to its name with its awesome gradient sunburst scheme.***

MODEL Airplane NEWS
FOUNDED 1929

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*MAIN COVER IMAGE: Hangar 9's Ultra Series PT-19 ARF is IMAA-legal and a great way to get into giant-scale warbirds. Chris Chianelli reviews the model on page 42. Insets: the Great Planes Slowpoke is a park flyer with personality. Randy Randolph provides his comments on the Slowpoke in his article on page 56. The Hitec Flash 5 radio is just one of 19 RC systems that are detailed in this month's "Budget Radio Guide."*

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## Construction



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## Reviews




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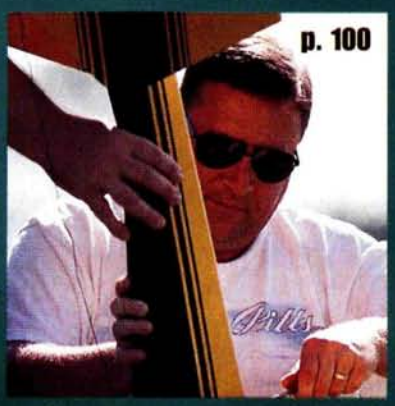

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## Columns



## Departments

# AIRWAVES

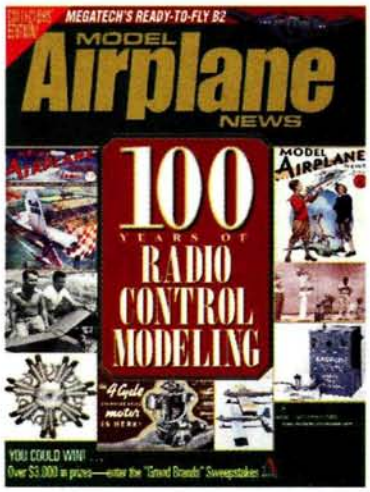
*Our readers write back*

**WRITE TO US!** We welcome your comments and suggestions. Letters should be addressed to "Airwaves," MODEL AIRPLANE NEWS, 100 East Ridge, Ridgefield, CT 06877-4606 USA; email man@airage.com. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we can not respond to every one.

## THE CENTURY OF RADIO CONTROL

*When Bob Aberle, Dave Gierke and Nick Ziroli Sr. joined forces to write "The Century of Radio Control" for the December '99 issue of* Model Airplane News, *they could not have anticipated the volume of mail and email this article would generate. Many of you responded to share your memories and experiences in RC and to add to this body of knowledge. We thank everyone who wrote and include this small sampling of your letters. DS*

I just polished off the wonderful tribute and history of the world of RC modeling in the December 1999 issue. Having started in RC modeling myself when I was a schoolboy in the late '50s and early '60s, I was especially intrigued by the story Bob Aberle wrote about the evolution of radios and systems springing from those times. My first RC flight was at the 10-switch controls of a hand-built reed system whose transmitter antenna was well over 8 feet tall from a transmitter mounted on a cart! I soloed for some time with much of the Citizenship single-channel equipment he pictured—tubes and all. I enjoyed the pictures and descriptions of the phases of RC control but was surprised that Bob didn't mention my own favorite of whimsy and finesse: the Galloping Ghost system!




I worked for Jack Laporte and John Mahoney one summer as a high school gofer and fabricator at Controlaire Electronics in Cincinnati, and my memory is that the Galloping Ghost was a much appreciated (and maligned) nifty precursor to their and other proportional controls that slowly arrived in the next few years. I was curious whether other modelers had the same fond memories of the amazing flights of fancy those ½A and larger planes displayed en route from escapements and reeds to what we all rely on so much today.

Great work on all phases of the remembrances of the 100 years!

THOM BUESCHER
*Camden, ME*

I thoroughly enjoyed your article, "The Century of Radio Control" in the December 1999 issue. However, I did spot one error on page 32 regarding the Bonner Duramite servo.

The Duramite servo, first produced in 1958, was an actuator for reed systems, not digital proportionals. This servo, which did not have an amplifier, required a separate relay for control actuation. The Transmite servo, circa 1959, contained its own transistor amplifier, eliminating the need for a separate relay. The Transmites were used in "relayless" reed systems.

In 1965, Bonner put into production the Digimite proportional system that used a Digimite, not Duramite, servo.

The Digimite 4RS system followed in 1967 (RS for "real small"). This system, I believe, was the first production 4-channel digital proportional system that weighed less than 1 pound (airborne weight 12 ounces) complete with batteries. You are correct in stating that the Digimite 4RS servo had limited control throw on its linear rack.

I am attaching some scans of Bonner advertisements from the '60s as reference for the above. FYI, I also have some Transmites and a functional 4RS system in my possession. [email]

MARK KUZAWINSKI

Your article in the December '99 issue of *Model Airplane News* covering 100 years of radio control modeling was impressive. I keep all of my issues, but I think I will keep this one in a special place!

However, I noticed that you didn't include a tribute to Nikola Tesla. According to Microsoft Encarta Encyclopedia 2000, "As early as 1897, he demonstrated remote control of two model boats on the lake in Madison Square Garden in New York City."

BERT SCHNEIDER
Oro Valley, AZ

Terrific job on the "Century of Radio Control" article. Congrats to those who assembled it.

I have a few additional bits: I believe the first model resojet was the Minijet—just a tad smaller in diameter but about the same length as DynaJet. I spent much of an afternoon with a couple of engineers from Revere Corp. trying unsuccessfully to keep it running for more than a few seconds. The Minijet had a pyramidal intake block with four separate reeds—quite unlike the flower-petal affair of the DynaJet.

In the early '40s, a friend of mine flew a Perky engine. This, I believe, had one of the first reed valves as well as cross-porting.

I think Ray Arden built a very tiny compression-ignition engine during the '30s—maybe as small as ⅛-inch bore. I saw it in one of the mechanical magazines.

Neither I nor my flying buddies in the Bell City Aeromodelers had any problem with the Ohlsson 19-23 engines we converted to glow ignition. I still fly, on occasion, a 50-year-old O&R .19-powered control liner. I recall running a McCoy black head .19 on gas and oil with pretty fair luck—but it ran hot. I also ran a Pacemaker 60 on various mixes of gas/alcohol/lighter fluid. This engine would sometimes stop with a loud bang and flip the prop off on gasoline, but it ran well on methanol. [email]

ROY CLOUGH JR.



# The latest gear for the new millennium

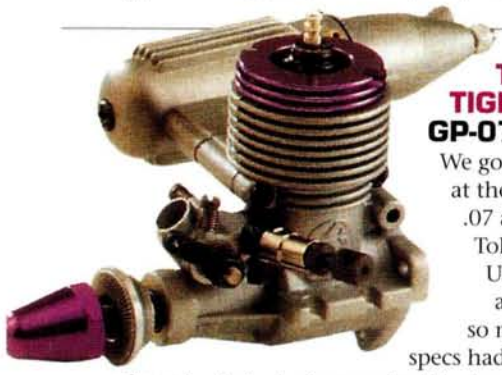
BY THE STAFF OF MODEL AIRPLANE NEWS

# New for 2000

## GOLDBERG'S ARF ULTIMATE NEWS

Remember when the Carl Goldberg Ultimate Bipe came out in 1990? Since then, it has become more than a great kit; it's an RC classic. To offer this well-known great flyer in ARF form is a smart move and further proof that the ARF revolution has reached a boiling point. It has the same dimensions as the kit (54-inch wingspan, 58½ inches long, .60 2-stroke or .90 to 1.20 4-stroke), but it's already built! Since it's from Carl Goldberg, it of course has a great Ultracote finish as well as painted, fiberglass wheel pants and cowl, a black, molded cockpit insert and Mylar decals. Add to these the pull/pull rudder, dual-servo ailerons and a steerable tailwheel, and you end up with aerobatics and beauty in an almost-ready-to-fly package! Price: $349.99.

Carl Goldberg Models, 4734 W. Chicago Ave., Chicago, IL 60651; (773) 626-9550; fax (773) 626-9566.



## THUNDER TIGER GP-07

We got our first peek at the Thunder Tiger .07 at the '99 Toledo show. Unfortunately, it was so new that the specs hadn't been released yet. And, since we lost the tug-o-war battle in TT's show booth, we had to wait till now to find out more. Well, fellow mini-modelers, it's finally here in all of its anodized glory. Officially, it's called the GP-07; it's rated for 0.19hp at 17,000rpm, and the engine has a practical range of 3,000 to 18,000rpm. Price: $45.

Ace Hobby Distributors, 116 W. 19th St., Higginsville, MO 64037-0472; (800) 322-7121; (660) 584-7121; fax (660) 584-7766.

## THUNDER TIGER WHISPER

If you've shied away from sailplanes and powered gliders because of their big size or complex wing construction, take a look at the new, ready-to-fly Whisper 1400. The fully assembled Whisper lets you enjoy the fun of silent flight, and its 55.1-inch span means you won't have to trade in the family car to haul it around. Thunder Tiger includes a 2-channel Hitec radio for elevator and rudder control as well as the necessary field equipment. The 1400 EP is powered by a Speed 400 motor, has a folding propeller, 600mAh power pack and a 30-minute DC field charger. Specifications: wingspan—55.1 inches; wing area—325 square inches. Prices: $139.99 (1400); $159.99 (1400 EP).

Ace Hobby Distributors Inc., 116 W. 19th St., Higginsville, MO 64037; (660) 584-7121.

## PTERYX SKYBIRD!

Cavemen looked at birds and dreamed of flight. They could jump off as many cliffs as they wanted; all it did was increase the quality of the gene pool. After planes were invented, we moved farther away from the dream of bird-like flight ... until now. The Pteryx SkyBird is a radio-controlled ornithopter (an aircraft that derives flight through flapping wings). And, as if that wasn't cool enough, it's an ARF! This 98-inch-span bird takes a normal .12 or .15 buggy glow engine and heavy-duty servos. There's even a Speed 300 motor to lock back the wings for gliding! The CNC-machined parts, full ball bearings and balsa/ply construction are just the tip of the iceberg. You have a choice of three colors and three different packages, each with successively more accessories. Stop jumping off those cliffs; join the world of ornithopters! Price: $550 to $750.

Pteryx Inc., 790 Tropical Ave., Chuluota, FL 32766; (407) 310-3554.

## NEW MAGNUM 2- AND 4-STROKE ENGINES


The folks at Magnum seem to be at the head of the class as far as safety concerns go; they have added rear mixture control on their .25 to .36 2-stroke engines. This trend seems to be catching on with engine manufacturers, and the more we see it, the better we like it.

The 25AII and 28AII offer the same case sizing as the current .25 and .28 but with a remote needle and carburetors. However, the .32 and .36 are all new from the ground up and have larger bore carburetors and revised case volume. These new engines feature chrome ABC technology and are supposed to be very powerful. Rumor has it that the .36 turns at more than 13,500rpm with an APC 10x6 running on 15 percent nitro. If this is true, those figures challenge engines in the .40 to .46 range.

Also shown is Magnum's all new .30XLFS 4-stroke, which features ball bearings and a dual-needle carburetor—far superior to an air-bleed type. Word is that the .30 turns an APC 9x5 at 12,000rpm on 15 percent fuel and idles all day long at 2,500rpm using an O.S. "F" plug. Moreover, reports have it turning a 10x6 prop at 10,000rpm; now that's usable power. Retail prices: $189.95 (.30XLFS); $109.95 (.25 and .28); $115.95 (.32); $119.95 (.36).

Global Hobby Distributors, 18480 Bandilier Cir., Fountain Valley, CA 92728-8610; (714) 964-0827; fax (714) 962-6452.

## HOBBICO'S SPECTRUM ARF


Hobbico's Spectrum is beautifully finished in bright, easy-to-see colors, looks as if it should be a great precision flyer, accepts optional retracts and tuned pipe and can be ready for the field in just a few nights. You can't ask for much more than that. The Spectrum features a wooden structure airframe, a fully symmetrical 56-inch wing, weighs in at 6 pounds, is 49 inches long and calls for .40 to .46 2-stroke or .70 4-stroke power. The independent ailerons and elevator servos and pushrods are excellent for precision linkage setup, and the checkered underside aids with in-flight orientation during aerobatics maneuvers. Retail price: $199.99.

Hobbico, distributed by Great Planes Model Distributors, 2904 Research Rd., P.O. Box 9021, Champaign, IL 61826-9021; (800) 682-8948; fax (217) 398-0008.


## AIRTRONICS VG400 AND VG600


When you fly, your comfort is more important than you think. The folks at Airtronics realize that, so when they designed their new 4- and 6-channel radios, they incorporated the extremely comfortable case shape of the more expensive RD6000 computer radio. The 4-channel VG400 has end-point adjustments for the throttle, and the 6-channel VG600 features EPA on the throttle, aileron, elevator and auxiliary channels.

Prices: $160 (VG400); $180 (VG600).

Airtronics, 1185 Stanford Ct., Anaheim, CA 92805; (714) 978-1895; fax (714) 978-1540.

# New for 2000


## JR XF421

If you've ever had any reservations about owning a computer radio, JR's XF421 could allay your fears once and for all. The JR gang has taken their popular 5-channel radio and added a computer-enhanced version to the lineup. The XF421 has servo reversing, travel adjustments, subtrim, two model memories, flaperon, Delta and V-tail mixing and a trainer mode. Best of all, to operate it, you need not attend night classes, obtain an engineering degree, or read a phone-book-size manual. A set of unique levers makes programming a snap. Price: $179.95.

Horizon Hobby Distributors, 4105 Fieldstone Rd., Champaign, IL 61821; (217) 355-9511.

## MEGATECH SKYLINER 3 RTF

With Megatech's Skyliner 3, you can go directly from the hobby shop to a flying site. No tools are needed to put it together; leave the glue at home. Just plug the charger into your car's cigarette lighter, install 8 AA batteries, strap on the one-piece wing and hit the throttle! The 3-channel Skyliner is packed with everything, including the radio, peak-detecting charger and 8.4V flight pack. Specifications: wingspan—34 inches; weight—21 ounces. Retail price: $299.95; street price: $199.95.

Megatech; distributed by America's Hobby Center, P.O. Box 32, North Bergen, NJ 07047-0032.

## COX ENTRY-LEVEL JET!

The folks at Cox have released their XB-29 Airlifter, *an entry-level jet*. This 50-inch-wingspan foam model features twin, electric, ducted-fan power. The big twin is unique in that it turns by using "thrust vector" steering. Say you want to go left; the right motor speeds up, and the left one slows down. You'll even *sound* cool saying "thrust vector" at the field! The model climbs with both fans at full and glides much like a sailplane with motors off. The XB-29 weighs about a pound and includes the 2-channel controller, charger and battery: everything you'll need for some fantastic foam-fan fun at the field. Price: $219.99.

Estes Industries, 1295 H St., Penrose, CO 81240; (719) 372-6565.

## AIRBORNE MODELS

Everywhere you look, the ARF phenomenon is exploding. Here's a company that is not only going to offer a very broad range of ARFs but is also apparently taking the level of completion to a new high: for example, its .46 2-stroke/.70 4-stroke-size Curtiss P-40. Even the rotating retracts are installed; I do believe that's a first.

As of this writing, AirBorne's line of hand-covered balsa ARFs includes subjects such as P-39; Zero; P-82 twin Mustang; Super Chipmunk; and this 73-inch-wingspan Breitling CAP, held here by the lovely Carly Kong.

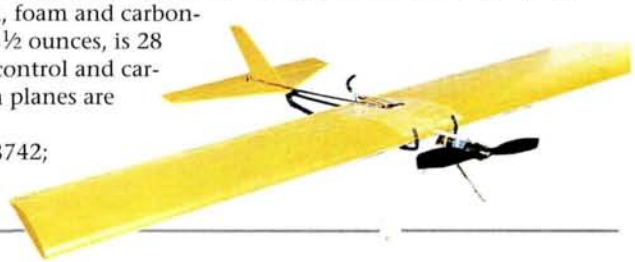

All these "kits" include details such as painted fiberglass cowls and pilot figures. The big CAP would surely make a nice Valentine's Day gift—especially from Carly! Call for prices.

AirBorne Models LLC, 2127-H S. Vasco Rd., Livermore, CA 94550; (925) 371-0922; fax (925) 371-0923.

# New for 2000

## DUMAS ENTERS THE WORLD OF MICRO FLIGHT

We pride ourselves on bringing you the latest stuff, and these two Dumas planes are as new as it gets; they should be available by the time this issue hits your mailbox or newsstand. The Metro Flyer is for outdoor flying; it is 24 inches long and has a 36-inch wingspan. This 3-channel, 7½-ounce craft is made out of laser-cut balsa, foam and carbon-fiber tube. The Kestral is made for indoor flight. It weighs 5½ ounces, is 28 inches long and has a 34-inch wingspan. It has 3-channel control and carbon-fiber rod, aluminum tube and balsa construction. Both planes are powered by six, 110mAh Ni-Cd batteries. Call for prices.



Dumas, 909-A E. 17th St., Tucson, AZ 85719; (520) 623-3742; fax (520) 620-1329; for catalog: (800) 458-2828, ext. 600.


## MULTIPLEX PICO AND COCKPIT

German radio manufacturer Multiplex has entered the domestic market with its new Pico and Cockpit radio lines. Multiplex radios have a unique look and feel and offer modular expansion capabilities; this means the radio can grow according to your needs. The 4-channel, entry-level Pico comes standard with V-tail, differential aileron and programmable mixing; from there, you can purchase individual upgrades to add up to three more channels. Multiplex also has an optional safety module that scans your radio frequency and won't switch on if someone is already using your channel. The Cockpit line has even more mixing functions and programming capabilities. Prices: from $245.

Multiplex USA, 4913 Revlon Dr., La Cañada Flintridge, CA 91011; (818) 790-0713; fax (818) 790-1346.



## SULLIVAN PRODUCTS MODEL PRODUCTS CORP. LINE

Sources say that Sullivan has acquired Model Products Corp. The packaging has been redesigned so we'll see that familiar Sullivan name, but the quality and prices will be the same as always. Their nifty product line now includes the Head Lock Remote. It can be installed directly on your engine so you'll never again have to drill holes in your cowl; simply route the cord to a more convenient place. Then install the Head Lock Glow Plug Connector, and you'll have a 30- or 48-inch cord between your flight box and your plane. Call for price.

Sullivan Products, P.O. Box 5166, Baltimore, MD 21224; (410) 732-3500; fax (410) 327-7443.

## GREAT PLANES ARF AEROBAT

What has a 52.5-inch wingspan, weighs about 5½ pounds, takes a .40 to .46 2-stroke or .52 to .70 4-stroke and is a great way to quickly get into high-level aerobatics? The Great Planes ARF Tracer .40, of course. Everything you need for a great flying plane is here: dual-aileron servos, dual-pushrod elevator, optional retracts and, for ease of assembly, all-wood construction. There's no point in investing your life savings to buy an aerobat when the 54-inch-long Tracer can easily keep up with the best of 'em! Price: $159.99.

Great Planes Model Distributors, 2904 Research Rd., P.O. Box 9021, Champaign, IL 61826-9021; (800) 682-8948; fax (217) 398-0008.

## AIRTRONICS MERCURY M

Have you ever found yourself watching heli pilots and thinking, "Hmm ... maybe I could do this."? With the inexpensive replacement parts offered by Airtronics for its new Mercury, maybe now is the time to go for it.

The Mercury weighs in at 7.3 pounds, calls for O.S. .46 power and requires a 5- or 6-channel radio with CCPM mixing. The kit includes ball-bearing-supported metal levers; aluminum stacked side frames; all metal rotor hub and engine mount; belt-driven tail rotor and one-piece, blow-molded, polypropylene canopy. With the Mercury M, you can practice your 3D maneuvers and not bankrupt yourself if you slip up trying that latest aerobatic trick. Price: $1,299.95.

Airtronics Inc., 1185 Stanford Ct., Anaheim, CA 92805; (714) 978-1895; fax (714) 978-1540.

# PILOT PROJECTS

*A look at what our readers are doing*


## 1999 PILOT PROJECTS WINNER

We at *Model Airplane News* receive hundreds of "Pilot Projects" entries every year. We pick our favorites for this section, but there can be only one winner. After long deliberation and debate, we have chosen Fred Tuxworth of Mattapoisett, MA, and his ⅛-scale Loening Amphibian, which he scratch-built using Smithsonian plans. Fred will receive $500 for showing that, in our hobby, the sky's the limit. Congratulations!

**SEND IN YOUR SNAPSHOTS.** ***Model Airplane News*** **is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable. We receive so many photographs that we are unable to return them.**

**All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of the year. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!**

**Send those pictures to: Pilot Projects, *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA.**

## HOPPED-UP HEINKEL

This Ziroli-designed He-162 Salamander (*Model Airplane News* plan no. FSP05961) was built by Darl McDiarmid of Klamath Falls, OR. It was originally designed as a bungee-launched electric, but Darl added landing gear, converted it to glow power and added an O.S. 25 with a Kress fan. With a 43-inch wingspan and weighing 56 ounces, this plane had logged eight flights when this picture was submitted.


## ¼-SCALE SCREAMER

Citrus Springs, FL, modeler Bret Martin built this gorgeous Cosmic Wind Little Toni from a Kitty Hawk models kit. The ¼-scale airplane has a 61-inch span, and we're told the plane flies scale-like, i.e., fast! The model is finished in polyurethane with graphics cut by Vinylwrite. It doesn't come as a big shock that the pylon racer lives up to its heritage, since Bret shoehorned a SuperTigre G90 under the cowl.

## CUB CONVERSION

Bill Pope taxies his Great Planes J-3 Cub on a lake near his home in Nestor Falls, Ontario, Canada. He used a Super Cub cowl over the O.S. .70 4-stroke powerplant and covered the model to match the full-scale plane that he owned 27 years ago. His wife, Nancy, shares in Bill's flying time. As a matter of fact, she's the one who took this beautiful photo.

## TRY AGAIN TOPPER

Rob Grindell of Manhattan, KS, tried to build this Topper back in 1947 as a 13-year-old boy. Because of its complexity, it didn't go well, but now that he has retired, Rob dusted off the original plans and built the Topper Redux. He equipped it with a Thunder Tiger GP .15 and a Hitec Focus 2-channel radio for throttle and rudder. The Redux is also flown as a free-flight model and is, says Rob, "a 13-year-old's dream."

## ST. JAMES STUKA

John T. Niezelski of St. James City, FL, performs a flyby with his Ziroli Stuka. The 28-pound dive bomber has scale-like flaps, dive brakes and, of course, bomb release. John has Futaba PCM radio equipment on board, and he uses a G-62 engine. The one year's building time that he invested was certainly worth it.


## TRULY AN OLD-TIMER

Dick Roe of Camarillo, CA, originally designed and built this airplane in 1937. He adds that it also has retractable landing gear that automatically fold into the fuselage after takeoff. Originally a free-flight model, Dick later adapted his creation for control line, and in 1998, he breathed new life into it by adding RC and an O.S. .46FX engine. This 77-inch-span bird now weighs 10½ pounds. As a side note, Dick's plane was originally featured as a free-flight model in "Gas Lines" in the August 1939 issue of *Model Airplane News*.

## BRAZILIAN BEHEMOTH

This 1/16-scale 767-200 is powered by two O.S. .61s. It was scratch-built by Rodrigo Gualhardo Klohn of São Luis, Brazil, and was detailed to match the planes used by TransBrasil Airlines. Rodrigo's monster has a wingspan of 120 inches and weighs 21 pounds! Constructed of foam and wood, this beauty also has retractable landing gear, flaps and outboard and inboard ailerons. Rodrigo says that "the model flies very gently, just like a big motor glider."

## SENSATIONAL CYCLONE

This attractive yellow and blue Cyclone is the work of Harry C. Dunlap of Summerfield, FL. He built the 80-inch-span plane using Ed Andrews plans, JR equipment for the radio gear and a G-62 for power. Harry writes that the plane "flies like a fun-fly airplane."

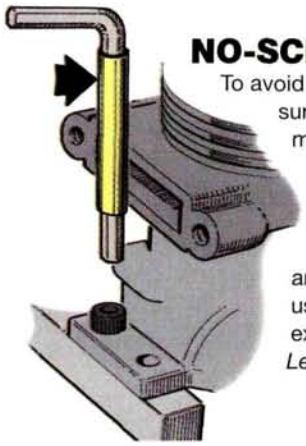
## MAKING BROWNIES


When Gerry Becker of Bellingham, WA, set out to make his first scratch-built airplane, he was looking for something that appealed to his love for older-style aircraft. The result is this 85.25-inch-span replica of the 1924 Bristol Brownie. Gerry used a Futaba 6-channel radio for control and an O.S. .61FX engine. After 15 flights and several IMAA events, the Brownie has proved itself to be a fun and smooth-flying platform.

# HINTS & KINKS

BY JIM NEWMAN

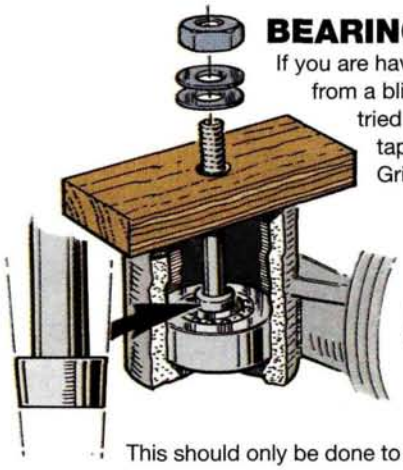
**SEND IN YOUR IDEAS.** *Model Airplane News* will give a free one-year subscription (or one-year renewal, if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman, c/o *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we can't acknowledge each one, nor can we return unused material.



## NO-SCRATCH KEY

To avoid scratching the muffler's mating surface as you tighten the engine-mounting screws, cover the shanks of your Allen keys with heat-shrink sleeves. A deep scratch on that surface encourages exhaust leaks and can damage any gasket used between the muffler and exhaust stub.

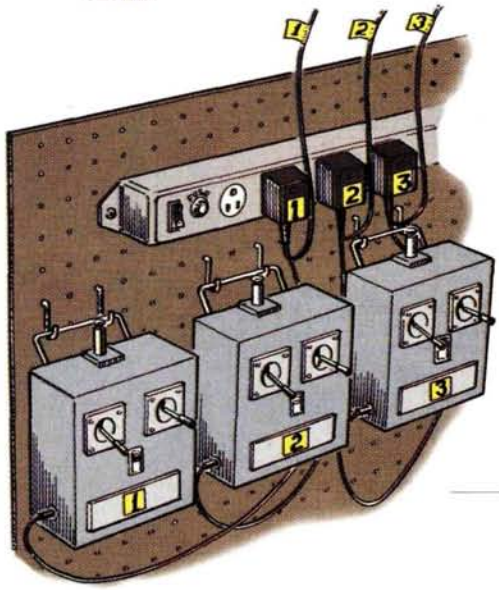
*Leon Brandon, Farmersville, TX*



## BEARING PULLER

If you are having trouble dislodging a bearing from a blind housing and you've already tried heating the engine case and tapping it on a wood block, try this. Grind a slight taper onto the head of an Allen screw of a suitable size, then drive it gently into the center of the bearing, headfirst. Place a drilled-out, hardwood block over the bolt, heat the case, then place washers and a nut on the screw. Draw the bearing out of the housing by tightening the nut. This should only be done to a bearing that is to be discarded.

*John Marien, Nashua, NH*




## CHARGE ORGANIZER

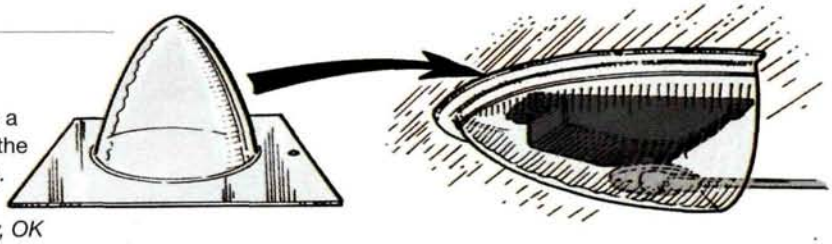
Mount a power-outlet strip with a built-in fuse on a perforated pegboard, then hang your transmitters on the board as shown. Number the transmitters and chargers to match the models hanging overhead so there is no confusion about which charger plugs into which TX and model. Install dummy (unconnected) plugs in the pegboard so you can "park" unused charge leads in them to avoid untidy tangles.

*Jay Crowley, Lake Tapawingo, MD*

## SERVO-SAVER

The plastic packaging from a spinner can be used as a streamlined fairing over a servo and will also protect the servo from damage when it is mounted below a wing. Attach it with canopy glue or adhesive trim tape.

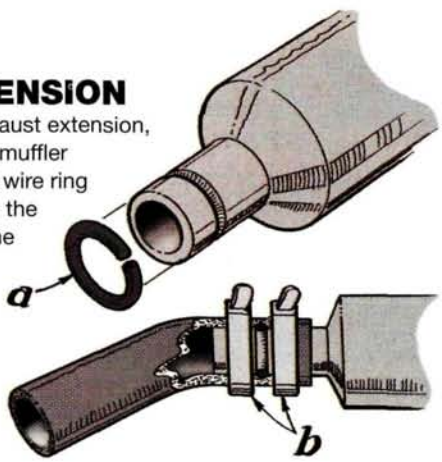
*John Ledford, Del City, OK*



## CAPTIVE EXTENSION

To avoid losing your exhaust extension, file a groove around the muffler tailpipe then snap a soft wire ring (a) into the groove. Push the rubber extension onto the engine and over the ring, then apply two tie-wraps (b) to secure it. An O-ring instead of wire will work well, too.

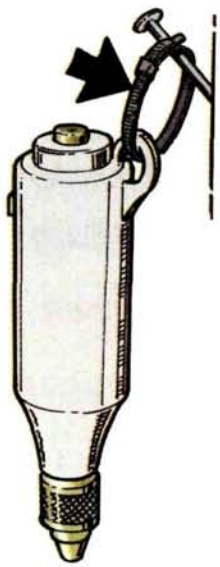
*Hovik Ghassemian, Glendale, CA*




## TOOL HANG-UP

Attach a tie-wrap to the hanging loop of your motorized tool. This will make it much easier to hang on a nail or hook and lessen the stress on the built-in loop.

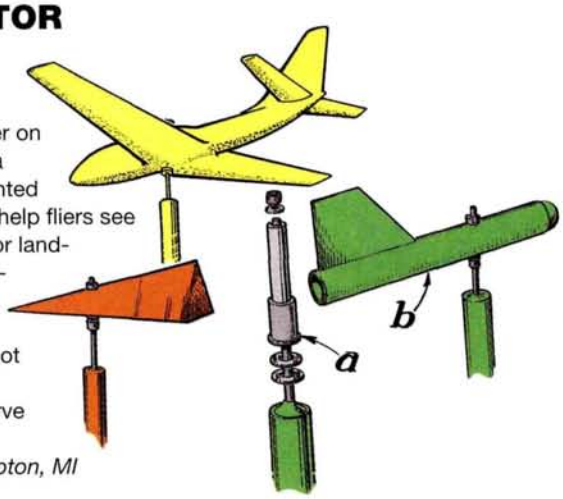
*Bob Krieger, Wheeling, IL*



## WIND INDICATOR

New fliers often have difficulty interpreting a wind sock, so Harold mounted this foam glider on a bushing made out of a spray pump (a). It is painted a bright color to further help fliers see the direction of takeoff or landing. Also shown are indicators seen at airports (b). These usually have wings, which are not needed on an RC field because we don't observe them from above.

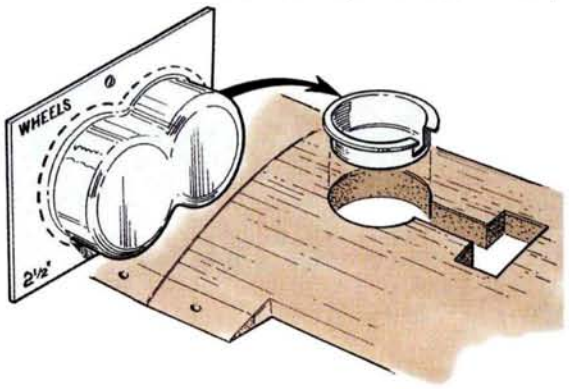
*Harold Watson, Lupton, MI*




## WELL, WELL, WELL!

The plastic covering from a wheel package makes a great wheel-well liner. Lightly sand the plastic to make glues and enamels stick better.

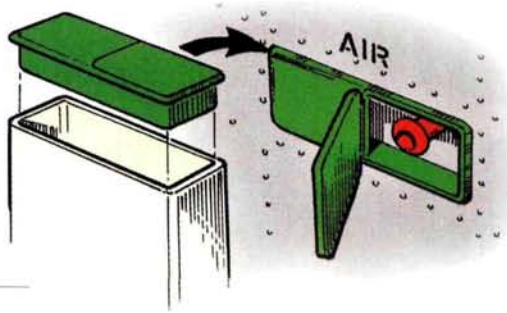
*Mike Garner, Ponte Vedra Beach, FL*

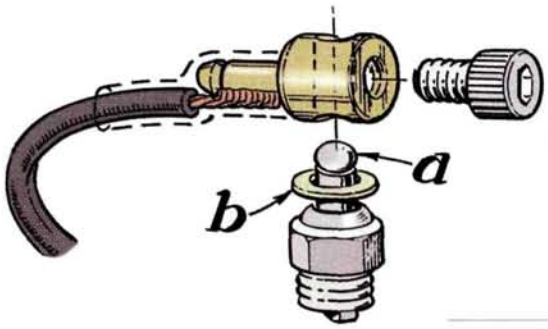



## MINTY ACCESS HATCH

To make a simple access hatch for retract or radio charging connections, glue in the lid from a Tic Tac box or a similar container.

*Steve Arnoczky, Sandusky, OH*




## GOOD CONNECTIONS

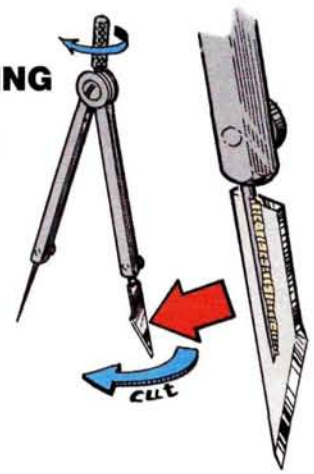
This remote glow-plug connector is a modified pushrod connector. Drill out the pushrod hole to fit the glow-plug post (a), then place an insulating plastic washer (b) on the plug before attaching the connector. The tightly fitting shrink sleeve is illustrated with a dashed line.

*Joe Letourneau, Brantford, Ontario, Canada*

## CIRCLE-CUTTING COMPASS

Glue a knife blade to the point of your dividers to make this covering-film circle cutter. Be sure the cutting edge is leading as you twirl it.

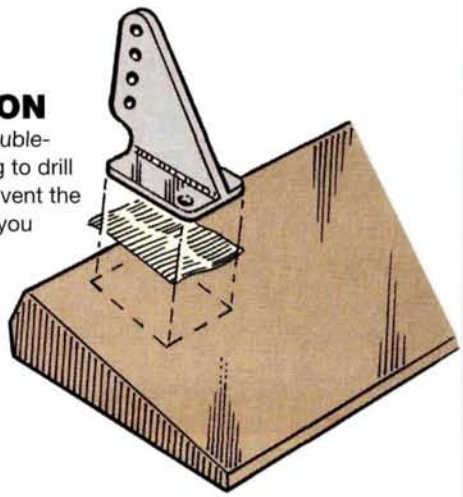
*Carl Diehl, Brentwood, CA*




## STICKY SITUATION

Attach control horns with double-sided tape before attempting to drill mounting holes. This will prevent the horn from sliding around as you mark its position. The tape can be left on because it will not be visible after the horn has been attached.

*Ric Rector, Redding, CA*



# BUDGET RA

*by the staff of Model Airplane News*

RADIO MANUFACTURERS TODAY pack an amazing amount of technology into systems that sell for only a fraction of the cost of yesterday's entry-level radios. A host of systems are available for less than $250, and with a little planning, you can choose a radio that fulfills all of your requirements.

When choosing a radio, first consider the basic type of RC system that you need. The simplest form is the non-computer, i.e., non-programmable system. Such a system will enable you to operate a single airborne pack (including battery, receiver and servos). On the other hand, a more sophisticated RC system will include a computer chip to store control commands and provide memory "positions" for more than one aircraft. This means you can operate several airborne packs from a single transmitter. Although we are looking at radios for the "budget" minded, the survey does include some powerful low-end programmable transmitters.

The type of model you expect to fly is also an important element that will influence your choice of radios. Do you wish to fly sport, aerobatic, or scale ships? How about sailplanes, fun-fly ships, or even helicopters? A key question is how many channels will you need for your application? And beyond that, will you need any special mixes or functionality?

For example, do you require flaps, a retract switch, dual rates, or exponential rate control? Whatever your requirements, try to plan so that the special control features you need will be available on your radio. Each radio surveyed has a brief description of its most important features and its estimated "street price." A chart at the end of the article allows you to compare prices.

Whether you're a seasoned veteran or a relative newcomer who's planning to purchase a new radio this season, this guide will help narrow your selection and show you how to get the most out of your modeling dollar.

## Airtronics VG400

The VG400 is a new 4-channel, non-programmable RC system that replaces the traditional Airtronics Vanguard system. The radio provides only a few extra control functions; one is end-point adjustment found exclusively on the throttle channel (the one place you really need it). A lightweight, approximately 1-ounce, 7-channel receiver is included with the system. Of course, with this transmitter configuration, only 4 channels are usable. This is a very simple-to-use radio system expressly intended for the novice and sport flier. **Street price: $160.**


## Airtronics VG600

The VG600 is a new 6-channel version of the VG400. Again, this is not a programmable radio. The added channels are for retracts and flaps (flaps are deployed by a 3-position switch that is not proportional, i.e., you have three fixed flap positions). On this larger system, you get endpoint adjustment on 5 of the 6 channels (the retract channel is excluded). Note, however, that there are no mixing functions, dual rates, or exponential rate controls. The same lightweight receiver comes with this system. Like the VG400, the VG600 is intended for the novice and sport flier. **Street price: $180.**

## Airtronics RD6000

Three types of models (airplane, glider and helicopter) can be controlled with the Airtronics RD6000. Two programmable and 13 control mixes are among this computer radio's highlights (see the August '99 issue of *Model Airplane News*). A unique new menu system makes this an ideal choice for th beginner or sport flier to transition to the use of a programmable radio. The menu allows you to call up a control surface, e.g., elevator, and then set the functionality, e.g., dual rate, to be applied to that control surface. It is one of the easier-to-learn interfaces and simplifies programming the mixes and functions you want. This system offers 4 mode memories, and that allows you to operate up to fou different airborne packs. **Street price: $250.**

# DIO GUIDE


## Futaba 6XA

The Futaba 6XA is a 6-channel programmable RC system. It has 3-model memory capability and can be configured both for airplanes and helicopters. The radio offers both dual and exponential rate controls and end-point adjustment on all channels. Nine mixing functions are available. This radio lies toward the upper end of our Guide in both capability and price. **Street price: $220.**


## Futaba Skysport 4

This entry-level, 4-channel unit has rechargeable batteries and can be linked to an instructor's radio. Unlike the Futaba 2-channel Attack systems, it has two, dual-access control-stick assemblies, i.e., there are two control functions on each stick. The radio offers regular ratchet control-trim functions on all 4 channels, as well as servo-reversing on all 4 channels. **Street price: $160.**


## Tower Hobbies 3000 4-FM

The 4-channel model 3000 covers the basics and skips the frills that would add to the cost. For the budget-minded, this is a good first radio. **Street price: $135.**

## Futaba 2DR/SR 2VR

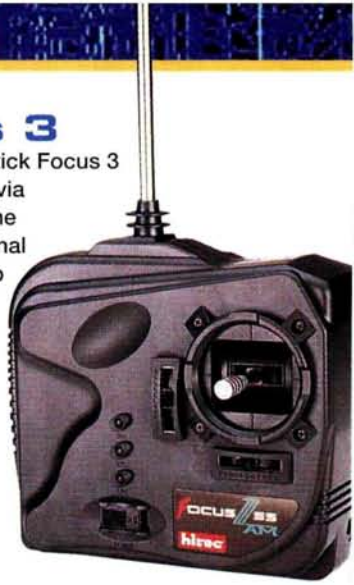
If you're looking for a budget-priced 2-channel aircraft radio, Futaba's 2DR and SR 2VR systems are very inexpensive. These radios offer pitch and turning functions that are on separate sticks. Unlike most conventional transmitters used in the U.S., they are, however, configured with the elevator channel on the left stick (as in foreign "mode 1"-style flying). If you are a beginner, ask yourself whether you wish to learn to fly using an unconventional stick setup. Futaba also includes a low-battery alarm for added safety when using non-rechargeable batteries. **Street prices: $65 (Attack 2DR), $70 (Attack SR 2VR).**


## Hitec RCD Focus 2

This 2-channel AM radio is available on 27 and 72MHz and combines the simplicity of 2 channels and the familiarity of "right stick," two-axis gimbal control. The radio is suitable for sailplanes using rudder and elevator control and for rudder and aileron control. It is an ideal lightweight, inexpensive system for small slope-soaring aircraft. **Street price: $70.**


## Hitec RCD Focus 3

Hitec's inexpensive, single-stick Focus 3 has V-tail and elevon mixing via dipswitches on the back of the transmitter case. A proportional third-channel lever on the top of the back of the transmitter is used for throttle. The AM or FM radio is available on 27 and 72MHz and is suited to deltas, sailplanes, V-tails, park flyers, slow flyers and many types of electric aircraft. **Street price: $85.**




## Hitec RCD Focus 6

The Focus 6 provides proportional flap control and retractable landing-gear capabilities as well as adjustable travel volumes for added value in a 6-channel package. **Street price: $180.**


## Hitec RCD Focus 4

The Focus 4 provides adjustable travel volume, i.e., endpoint adjustment, on all channels and comes standard with four servos. This radio offers a trainer system and is a solid beginner system at a good price. **Street price: $140.**


## Hitec RCD Prism 7XF

This 7-channel programmable unit is available in two interesting configurations. In its basic configuration, it uses a single radio frequency (any of the 50 available) and offers subtrims on all channels as well as eight separate control mixes. The radio has three model memories: the basic system includes four servos, receiver and charger, as is typically provided by radio manufacturers.

Note, however, that you can also buy the Prism 7XF with the Spectra frequency synthesizer. The Spectra frequency synthesizer enables you to program the radio to broadcast a signal on any of the 50 available aircraft frequencies, and you can adjust the synthesizer to accommodate positive or negative signal shift. That means you can use the radio for any FM receiver you own! The street price of the basic system is $230. The transmitter can also be purchased without a receiver or servos but with the Spectra synthesizer and a charger in a special package. **The street price for the special package is only $200.**


## GLOSSARY OF RADIO TERMINOLOGY

**ATV** (adjustable travel volume). It electronically sets the total distance that a servo arm pivots in each direction (often called endpoint adjustment—EPA).

**Buddy box**. A transmitter linked via a cable to that of an instructor; it allows shared control of an airplane and is a valuable training aid.

**BEC** (battery eliminater circuitry). Allows electrical power from one battery to power both a motor and a radio.

**Channel**. Any control or accessory that is manipulated via a transmitter. The four basic channels are: aileron, elevator, throttle and rudder.

**Dual rates**. Transmitter switch enables you to reduce the amount of servo travel (usually for the aileron, elevator, or rudder channel functions) to a lesser degree of travel. In other words, it reduces control throw at the flip of a switch, making the controls less sensitive.

**EPA** (endpoint adjustment). Electronic adjustment of a servo's maximum pivoting distance (often called ATV).

**Exponential**. Nonlinear control response in relation to stick input that doesn't alter the total control throw; it allows a less sensitive "feel" around the neutral stick position.

## Hitec RCD Flash 4 System X

The Flash 4 System X features 5-model memory and exponential rate control. The new X version has automatic saving of control inputs so that manual saving is not needed. All control inputs are automatically saved when you move to the next menu item. It has digital trims that are represented on the LCD screen by numerical values. **Street price: $175.**


## Hitec RCD Flash 5 System X

A more advanced radio than the Flash 4, this offers a fifth channel, flaperon mixing, camber adjustment and three flight modes. Modes include acro (aerobatic flight), glider (soaring applications) and glidacro (a combination, as in F5B sailplane aerobatics and slope aerobatics). A capable system. **Street price: $195.**



## Multiplex Brick and Pico International

German radio manufacturer Multiplex entered the domestic radio market with its upgradable Pico computer line. These are offered in 4- and 5-channel configurations. The 4-channel system includes a modular receiver and a pair of servos in a single unit called the "Brick." A 5-channel "International" version has a conventional receiver and servo setup. Both radios include V-tail and programmable mixing. Owners can expand the radios' capabilities to 7 channels and add features by purchasing upgrades. **Street prices: $240 (Pico Brick), $250 (Pico International).**

**Frequency**. Separations of 0.020kHz of the 72.990MHz radio band. Channel numbers 12 through 60 correspond to 72.030MHz through 72.990MHz.

**Mixing**. This allows two channels to be combined for enhanced airplane control, e.g., elevator/flap and aileron/rudder.

**Model memory**. Flight parameters, trim settings and often model names can be stored in the transmitter. This allows you to preset the radio for a variety of flight conditions and airplanes.

**Programmable mixing**. One control (master) has a proportional effect on another (slave) channel, e.g., low throttle could proportionally deploy flaps.

**Servo-reversing**. The ability to change the output direction of servo-arm movement in relation to control-stick movement.

**Standard receiver channels**. The maximum number of servos for a receiver.

**Subtrim**. Finite electronic adjustment of a servo's neutral point.

**Synthesized module**. Plug-in component that allows you to alter the transmitter's frequency.

**Trainer system**. Transmitter cable link that allows a student to share aircraft control with an instructor.

**Trim type**. Ratchet-style trim is a slide potentiometer with notched "stops" as opposed to digital that consists of a two-way momentary switch.

## JR XF421EX

JR has combined the functions and features of the 400EX with the precision control of a computer radio system. It is described in JR's literature as "... the first computer radio without all the bells and whistles." It features 2 model memories, servo-reversing, end-point adjustment and subtrim on each of the four channels— all controlled by easy-to-use levers on the radio case. **Street price: $180.**


## JR F400EX

This is a basic system with a fifth channel that can be used, for example, for retracts, and it comes at a mid-range price. Adjustable stick length complements the standard servo-reversing capability found in most radios. **Street price: $160.**


| | MFR. | MODEL | CHANNELS | SERVOS INCLUDED | TRAINER CAPABILITY | EPA | MIXING FUNCTIONS | DUAL RATES | EXPO | MODEL MEMORY | TRIM TYPE | VOLTAGE INDICATOR | RECHARGEABLE BATTERIES | STREET PRICE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LESS THAN $100 | Futaba | Attack 2DR | 2 | 2 | No | No | 0 | No | No | 0 | Ratchet | 2 LED | No | $65 |
| | Futaba | Attack SR 2VR | 2 | 2 | No | No | 0 | No | No | 0 | Ratchet | 5 LED | No | $70 |
| | Hitec | Focus 2 | 2 | 2 | No | No | 0 | No | No | 0 | Ratchet | 3 LED | No | $70 |
| | Hitec | Focus 3 | 3 | 2 | No | No | 1 | No | No | 0 | Ratchet | 3 LED | No | $85 |
| | Tower | 3000 4-FM | 4 | 4 | Yes | No | 0 | No | No | 0 | Ratchet | Analog meter | Yes | $135 |
| LESS THAN $175 | Hitec | Focus 4 | 4 | 4 | Yes | Yes | 0 | No | No | 0 | Ratchet | Analog meter | Yes | $140 |
| | Futaba | Skysport 4 | 4 | 4 | Student | No | 0 | No | No | 0 | Ratchet | Analog meter | Yes | $160 |
| | JR | F400EX | 5 | 4 | Yes | No | 0 | No | No | 0 | Ratchet | Analog meter | Yes | $160 |
| | Airtronics | VG400 | 4 | 4 | Yes | Throttle | 0 | No | No | 0 | Ratchet | 5 LED | Yes | $160 |
| LESS THAN $200 | Hitec | Flash 4X | 4 | 4 | Yes | Yes | 3 | No | Yes | 5 | Digital | LCD numeric | Yes | $175 |
| | JR | XF421EX | 5 | 4 | Yes | Yes | 3 | No | No | 2 | Digital | LCD numeric | Yes | $180 |
| | Hitec | Focus 6 | 6 | 4 | Yes | 4 | 0 | No | No | 0 | Ratchet | Analog meter | Yes | $180 |
| | Airtronics | VG600 | 6 | 4 | Yes | 5 | 0 | No | No | 0 | Ratchet | 5 LED | Yes | $180 |
| | Hitec | Flash 5X | 5 | 4 | Yes | Yes | 3 | Yes | Yes | 5 | Digital | LCD numeric | Yes | $195 |
| LESS THAN $250 | Futaba | 6XA | 6 | 4 | Yes | 6 | 9 | Yes | Yes | 3 | Ratchet | LCD numeric | Yes | $220 |
| | Hitec | Prism 7XF | 7 | 4 | Yes | Yes | 9 | Yes | Yes | 3 | Digital | LCD numeric | Yes | $230 |
| | Multiplex | Pico Brick | 4 | 2 | No | No | 2 | No | No | 0 | Ratchet | LCD numeric | Yes | $240 |
| | Multiplex | Pico Int. | 5 | 4 | Yes | Yes | 2 | No | Yes | 0 | Ratchet | LCD numeric | Yes | $250 |
| | Airtronics | RD6000 | 6 | 4 | Yes | 6 | 15 | Yes | Yes | 4 | Digital | LCD numeric | Yes | $250 |

** The addresses of the companies featured in this guide are listed alphabetically in the Index of Manufacturers on page 142.*

# DAYTON

## *A premier event at aviation's birthplace*

***There's just nothing better than blue sky and lots of smoke, as demonstrated by this biplane and gorgeous SNJ.***

***NCFFA champion Jerry L. Smith of Paducah, KY, performed his noontime flight demo and left little doubt why he has won the title so many times.***

***Reenacting Chuck Yeager's supersonic flight, Mac Hodges dropped this X-1 from his big B-29. Just when you were convinced this was a "glide-only" drop, fellow pilot Dan Stevens hit the go button.***

# GIANT-SCALE FLY-IN

*by Bob Hastings*

***Terry Nitsch taxis out the Yellow Aircraft F-18 owned by AMT's Jim Caigle. All eyes—and cameras—were riveted on the turbine-powered jet during its flight.***

***Ohio's Bill Barber performs a show pass for the crowd with his big "Black Baron" Stearman. The 3W 140-powered bipe flies with incredible realism.***

Imagine a three-day festival featuring pilots straight from the rosters of Top Gun, Tournament of Champions, Competition Fun-Fly Nationals and the Quarter Scale Racing Association; the best RC modelers gathering from around the nation to fly models ranging from kero-fired turbines courting 200mph to infinitely detailed warbirds with 20-foot wingspans. Hold this event at one of the most hallowed sites of aviation—Wright-Patterson Air Force Base—and you'll begin to understand why 10,000 plus spectators attend the Dayton, OH, Giant-Scale Fly-in that's billed as "one of America's premier events."

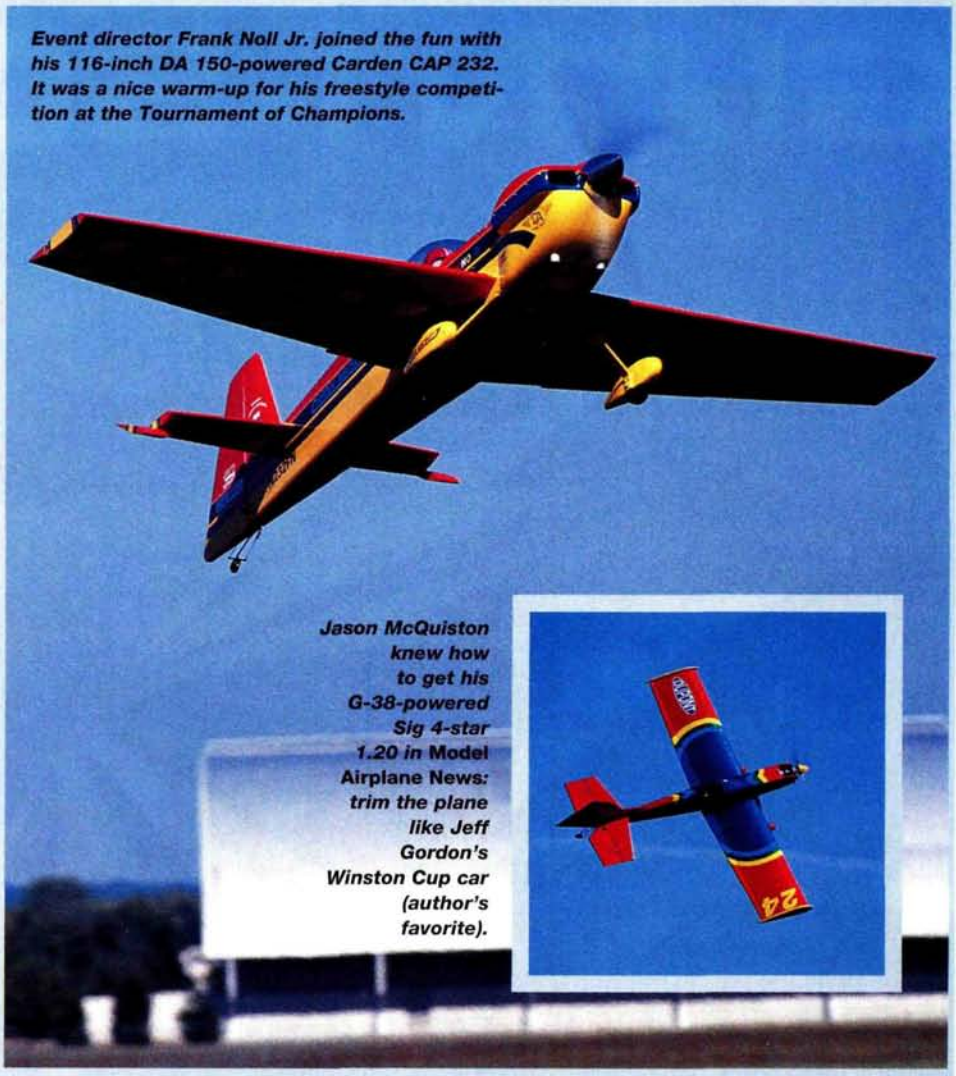
The fly-in is held on the runway that now exclusively serves the USAF Museum. You stand on the same asphalt as has seen so many aviation legends roll by. Myriad full-scale military aircraft continuously roar past, including F-15s in tight formation on their way to the active portion of the base. You can't help but be awed.

A well-organized impound and flightline led by event director Frank Noll Jr. allowed plenty of flight time for pilots at the six separate stations. It was truly spectacular to watch the nation's top RC competitors fly without judges, score-keepers, or timers. These "big guns," while impressive, were certainly not in the majority of pilots. They shared the skies with fellow giant-scale modelers who were there solely for the enjoyment of the sport, to the delight of participants and spectators alike.

PHOTOS BY BOB HASTINGS

There were numerous highlights throughout the weekend. Indiana's Don Albright flew his enormous 20-foot B-29. The majestic flight not only caught the eye of museum director Maj. Gen. Charles D. Metcalf, but it also caused a stir when it showed up on radar screens across the base! Georgians Mac Hodges and Dan Stevens reenacted Chuck Yeager's supersonic first flight with incredible realism. Just when you were convinced the X1-A was going to do a "glide only" flight, Dan fired off an onboard rocket, and the bright orange replica streaked skyward again. The crowd was wowed by several midday demos, including a massive, pyrotechnic-charged WW II bombing raid. Jerry Smith of Kentucky performed his "Hot Wings" aerobatic routine, giving everyone a glimpse of why he has so often been the NCFFA champion. Illinois hotshot Mike McConville put on an astounding performance with his big Carden plane. His incredible maneuvers could get him arrested for breaking the laws of physics and aerodynamics. Turbines were well-represented, as Louisville's George Thomas and Lewis Patton teamed for an F-15 versus MiG 15 jet sortie. With the choreography, grace and precision of a figure skater and the subtlety of a NASCAR race, Terry Nitsch of Columbus, OH, took the highly modified Yellow Aircraft F-18 owned by AMT's Jim Waigle up for a full-throttle demo of maneuverability, speed and precision. He ran the bright pink jet down on the deck, flew circles within a wingspan of the ground and then up again, using every inch of the Dayton sky.

On Saturday evening, pilots and families were treated to the opportunity of a lifetime. The Wright-Patterson Air Force Base Museum graciously welcomed modelers for an exclusive open-cockpit evening. How truly special it was to view, climb the ladders of and actually touch the single greatest collection of full-scale aircraft on earth. We still felt awed when we returned to the runway the next day. A



***Event director Frank Noll Jr. joined the fun with his 116-inch DA 150-powered Carden CAP 232. It was a nice warm-up for his freestyle competition at the Tournament of Champions.***



***Jason McQuiston knew how to get his G-38-powered Sig 4-star 1.20 in Model Airplane News: trim the plane like Jeff Gordon's Winston Cup car (author's favorite).***


***Above and left: this Ziroli P-38 is the first scale effort from Byron Striker of Elyria, OH. The 47-pound Lightning is finished with pressed newspaper lithoplate and enamel paint.***

***Below: Curtis Adams' (Lexington, KY) Sachs 5.8-powered Stearman rolls out for another aerobatic flight.***

# United States Air Force Museum

The United States Air Force Museum at Wright-Patterson Air Force Base near Dayton, OH, under the direction of retired Air Force Maj. Gen. Charles D, Metcalf, is internationally recognized as the largest and oldest aviation museum in the world. Its collection comprises more than 300 aircraft in addition to countless interactive displays, missiles, artifacts and memorabilia.

Partitioned into separate galleries, the museum's aircraft are organized chronologically. "The Early Years" covers aviation's pioneering efforts, which began right in Dayton, through the preparation for WW II. The 1940s come alive within the "Air Power" gallery. Approximately 20 aircraft comprise the Vietnam/Korean War gallery, all standing in the shadow of the incredible Convair B-36J. One particularly intriguing display is an F-86H with its fuselage skin completely removed. Its internal structure and technological complexity will amaze you. The "Space" gallery is dominated by the Apollo Command module and the Gemini and Mercury spacecraft. It's remarkable to actually see historic items that have been the subject of newsreel memories.

After touring the "Modern Flight" hangar, you'll feel your national pride swell exponentially, and you'll appreciate all the advances in aviation as you never have before. To see the sole XB-70 Valkyrie in existence, to touch the SR-71 Blackbird—all within a few paces of the F-117A and YF-22; it's little wonder the museum welcomes a million people annually and is Ohio's leading non-commercial attraction.

Within a mile of the main site, hangars dedicated to presidential aircraft, research, development and restoration are accessible by special authorization. The facilities offer a rare opportunity for the aviation fan and historian.

There's no charge for admission, and the museum is open daily from 9 a.m. to 5 p.m. except on Thanksgiving, Christmas and New Year's Days. Their address is: United States Air Force Museum, 1100 Spaatz St., Wright-Patterson Air Force Base, Dayton, OH 45433-7102; (937) 255-3286. For a virtual tour, visit their website at www.wpafb.af.mil/museum.

*Is this an optical illusion? No; it's actually a 1/2-scale Aeronca Champ built by Indiana's Ron Goodrich.*

*Left: Don Albright's 20-foot-span B-29 is powered by four Quadra 100s and requires two Airtronics radios to operate its 24 servos! Below: Dan Stevens of Georgia seemed to be at the controls of only unique planes such as this SuperTigre-powered Japanese Shinden that he built from enlarged Thacker plans.*

*Retired Maj. Gen. Charles D. Metcalf, director of the Air Force Museum, discusses some aerobatic maneuvers with his wife.*

special IMAX movie screening was held for those who could tear themselves away from all the splendid static aviation.

The Dayton Giant-Scale Fly-in offers so much that you should mark it on your calendar in indelible ink. For the aeronautically obsessed, there's enough full-scale and RC eye candy to make you grin and giggle for the better part of a week. Gather up your camcorder, airplane, family and club members, and head out to Dayton next Labor Day! For more information about the 2000 fly-in, email fnolljr@compuserve.com.

**Addresses are listed alphabetically in the Index of Manufacturers on page 142.*

MODEL AIRPLANE NEWS
ENGINE
REVIEW

# Norvel BigMig .074 Revlite

## Power to please

The bolt-on muffler is sealed with a gasket, and this ensures a cleaner running engine with improved muffler pressure to the fuel tank.

PHOTOS BY RANDY RANDOLPH

*by Randy Randolph*

It was the sort of news that makes an engine guy smile, particularly one who's a big ½A fan. Norvel*, a company with a reputation for exceeding expectations, promised that its new .074 would have the power of a .10 at only half the weight. The .074 has all-aluminum piston and cylinder technology and special oxide ceramic coatings. My anticipation grew with the hope that my previous, disappointing .074 experiences would be distant memories.

I had been flying a square and simple ½A control-line model with a rather tired Spitfire .045 engine. The airplane flew with very little enthusiasm. When the OK Cub .074 burst onto the modeling scene at a most attractive price, I decided it was just the engine to add zest to my airplane. Unfortunately, my airplane didn't gain the performance I had hoped it would.

Fifty years later, along came the Queen Bee .074. The Queenie looked good and ran well and was stronger than the poor old Cub at ⅓ throttle, but it still left me looking for something more.

My close encounter of the third kind was with the Norvel BigMig .074 RC. This engine is truly an improvement over previous ½As and actually gives the .09s good competition in the power department. Although the engine's larger size necessitates the use of an .09-size mount, the power available is well worth an extra 10 or 12 grams.

One of the noteworthy refinements in this BigMig is the bolt-on muffler with a gasket between the muffler and exhaust stack. This is a real improvement over the spring arrangement on smaller engines because the seal provides good muffler pressure to the tank through the provided tap. Also of interest is the fact that the carburetor can be rotated 180 degrees so the fuel and throttle connections can be aligned with any previously installed engine. Be careful when you're adjusting the needle valve in this transposed orientation because it does move the needle valve closer to the muffler. The engine has a slightly larger bore so it comes with the Freedom 7L glow plug, which is slightly different from those used on Norvel's smaller engines.

The larger cooling fins and markings are unique to the .074, but the case appears to be an enlarged version of Norvel's popular .061. By removing the nut just below the fuel intake, the carburetor can be rotated 180 degrees.

I mounted the engine on my test stand and installed a light-load Cox* gray 6x3 break-in prop. After filling the fuel tank with 15 percent nitro and 18 percent oil (a percentage of which is castor), I opened the needle two turns. I placed my finger over the carb and turned the propeller three revolutions to prime the engine. With one flip, the engine started immediately. I left the needle on the rich side for three tanks of fuel before leaning it out. After an hour of break-in with the muffler in place, the .074 twisted that 6x3 prop up to a little over 19,000rpm—a pretty nice number! By far the most impressive number was the 15,500rpm finally achieved with a Cox gray 7x3 I will use when flying. By the way, the Cox prop must be drilled out with a 5/32-inch bit to fit the BigMig .074 shaft. Both the Graupner* and APC* 7x3s required shims to fit the shaft, and the engine lost about 800 or so rpm with each of those props. In all cases, the lowest reliable idle was just a shade below 5,000rpm, and throttle response was excellent!

A lot of BigMig .074 RCs are going to be sold, and they will make a lot of people very happy. This is an easy engine to handle; the needle is not critical, and starting is a snap. This is a modern engine with all the refinements that current technology has to offer at a price that's sure to please.

*Addresses are listed alphabetically in the Index of Manufacturers on page 142.* ✦

### SPECIFICATIONS

**Model**: BigMig .074

**Manufacturer**: Norvel

**Part no.**: NVLB7R

**Displacement**: .074ci (1.2cc)

**Bore**: 0.46 in. (11.75mm)

**Stroke**: 0.43 in. (11mm)

**Weight**: 2.65 oz. (75g), including muffler

**Height**: 2 15/16 in. (74.61mm)

**Horsepower**: 0.38 at 22,000rpm

**Case length**: 2 5/8 in. (66.67mm)

**Case width**: 13/16 in. (20.63mm)

**Muffler**: rotating bolt-on with gasket and pressure tap

**Glow plug**: Freedom 7L (included)

**Piston/sleeve**: Revlite AAO (aluminum piston, nickel-plated, aluminum cylinder, oxide ceramic coating)

**Carburetor**: single needle

**Fuel used**: 15 percent nitro; 18 percent oil

**Rpm**: 19,000 w/Cox 6x3; 15,500 w/Cox 7x3

**Price**: $49.99

**Comments**: powerful output comparable to .10-size engines but weighs 50 percent less. A reversible carb and gasket-sealed muffler are just two of this engine's highlights.

# Astro Flight News

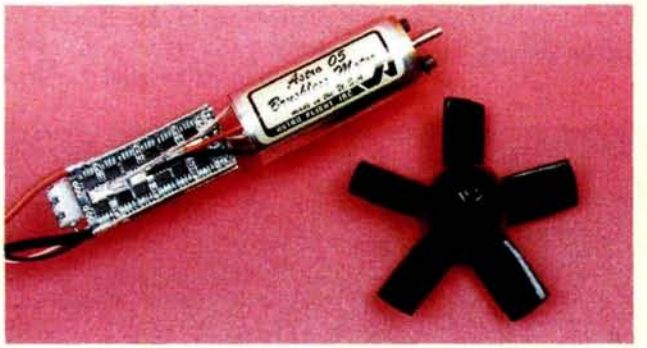
**Astro Flight Inc. Introduces five new and exciting products for the electric flyer: The new Mighty Micro 010 Brushless Motor for park flyers, a new Ducted Fan Brushless 05 Motor for the Kyosho T-33, FAI-035 and FAI-05 Planetary Motors for Sailplanes and two new surface mount digital speed controls.**

### The Mighty Micro is here!

Our new Mighty Micro Brushless 010 Motor #801 has arrived. The motor is one inch in diameter and one inch long and weighs only 35 grams with sensorless control. It spins an APC 6x2.8 prop at 9800 RPM while drawing only 2.5 amps from a six cell 350 mahr Nicad pack. Now you can fly for 5 minutes on Nicads, 10 minutes on Hydrides and one hour on lithium cells. The tiny On-Off Brushless control has Brakes and BEC. This system will work with 5 to 8 cell batteries. Perfect for models up to 10 oz.

### New Ducted Fan 05 Motor!

Our new 4 turn Brushless 05 Ducted Fan Motor #805F with 12 FET controller is specially designed to add Afterburner performance to the Kyosho T-33 and WE-Mo-Tek 480 ducted fan units. Run the T-33 fan on 8 or 9 Nicads or 10 Sanyo 3000 mahr Hydrides. The motor draws only 19 amps for 10 minute flights on Hydrides.

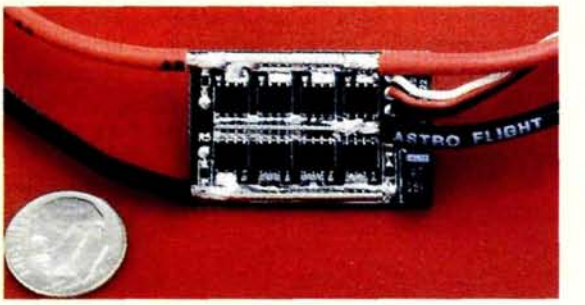


### FAI-035 with Planetary Gearbox

Our new 4.4:1 planetary gear box is now available for all Astro Cobalt 035, 05 and 15 motors. The FAI-035 with planetary gear box is perfect for 7 cell competition sailplanes. The FAI-05 with planetary gear box, shown here, is perfect for 10 cell sailplanes.

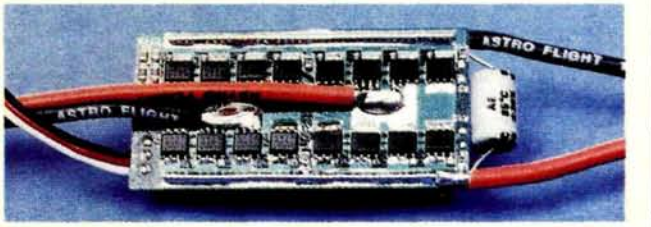

### New Astro 215D Airplane Control

The new Astro 215D Speed control uses new surface mount technology for minimum size and maximum performance. The tiny 215D weighs only 8 grams and has Brakes and BEC. It handles up to 30 amps and 10 cells. Perfect for Astro Cobalt 035, 05 and 15 motors.




### New 208D Reversing Control

The new 208D Reversing Control is designed for scale boats. It's 16 FET H-Bridge circuit gives you full power forward and reverse. The 208D weighs 1 oz and can handle 25 amps at 6 to 12 volts. It has a 2 amp BEC and a electronic current limit of 28 amps, so no fuses are needed. It was designed for tug boats and works great with 150 pound robots and electric powered blimps.

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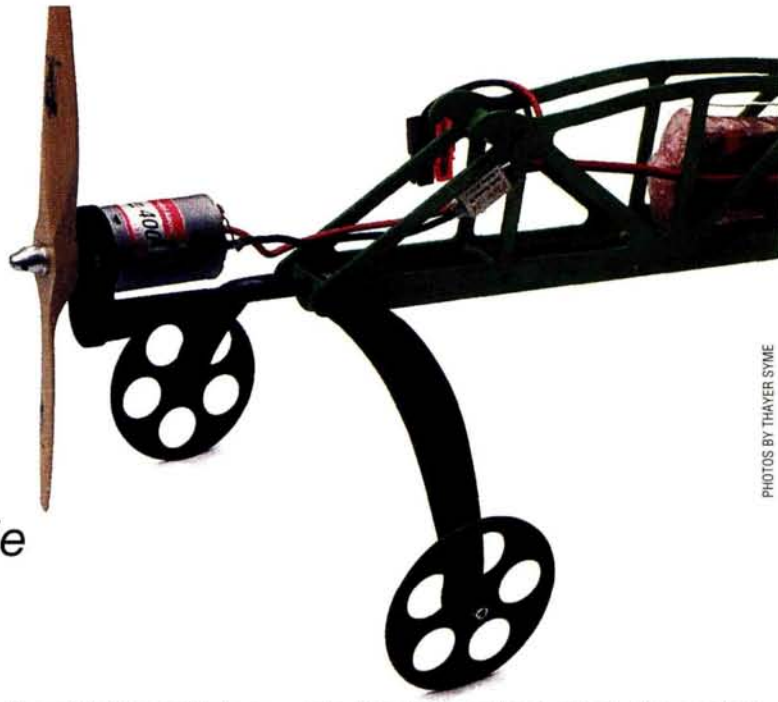
Phone (310) 821-6242 Fax (310) 822-6637 Web Site http://www.astroflight.com

MODEL AIRPLANE NEWS
HOW TO

# Make Your Own Carbon-Fiber Landing Gear

## *Lightweight, sturdy and simple*



PHOTOS BY THAYER SYME

*by Thayer Syme*

FROM TIME TO TIME, a model comes along that does not lend itself to landing gear made with traditional materials. Especially with the very popular slow and park flyers, weight is critical. This prevents you from using heavy anchor blocks for torque wire, multiple pieces of braced wire, or sheet aluminum. When confronted with a situation like this, custom landing gear made out of carbon fiber and epoxy makes a lot of sense. The use of composites is uncommon for landing gear. This is a shame, as it is quite possible to make stronger and lighter landing gear with these materials. Let's look at a typical park flyer to trace the steps of making and installing carbon-fiber landing gear.

The Diversity Aircraft* Dragonfly is a 48-inch-span, 450-square-inch foam-wing park flyer that has a direct drive S-400 for power. Its flying weight is 15 ounces. The original landing gear was made out of music wire sandwiched between two layers of plywood in the motor mount. The gear would often split the mount because of the inevitable bumps and bruises of landings while pilots learned how to fly. The gear's excessive flexibility also allowed the wings to drag while landing or taxiing.

To avoid these problems, I decided to try a new set of vacuum-bagged, carbon-fiber gear and mount it on the carbon-fiber fuselage backbone and plywood frame. Mounting the new landing gear on the fuselage instead of on the motor mount helps stabilize things, but it also changes the plane's balance and ground handling. I will look at all of these concerns as I complete the project. Vacuum-bagging eliminates the need for any excess resin, making the part even lighter and stronger.

***Basic landing-gear form shaped from 2x4 and covered with clear MonoKote.***

***Landing gear on form ready to be vacuum-bagged.***

### THE MOLD

Make a very simple mold using a piece of scrap pine 2x4. Keeping the intended track and height of the landing gear in mind, I made my mold 3 inches tall and 8 inches wide. I cut the edges of the block by making a gentle arc from the midpoint on the top to the bottom on each side. After sanding the block, I covered it with MonoKote*, which does an excellent job of sealing the mold's surface and also acts as a release agent for the carbon fiber. Even without wax on the MonoKote, the finished product was released with little trouble.

You should prepare everything before you mix your epoxy. Clean up your workspace and cover the bench with cardboard or plastic. Measure the total length of the landing gear going around the curved surface of the mold, add a little length to be safe, and then cut all the carbon fiber that you'll need for the layup. Decide how much material it will take for the project, either by analysis or by trial and error.

### SAFETY FIRST!

**Whenever working with composite materials, common sense should rule the day. For personal safety while doing this or any project involving epoxies with carbon fiber or fiberglass, I use and recommend that you use a barrier cream on your hands as well as a pair of thin rubber gloves. A respirator and a fan are also a good idea to help you avoid inhaling epoxy fumes or stray fibers.**

**Unlike wood splinters, bits of carbon fiber or fiberglass are difficult, if not impossible, for your body to recognize. Triggering of natural defense mechanisms is therefore much less likely to occur. Cleanup is best handled with white vinegar followed by soap and water. I have read enough horror stories about overexposure to epoxies as well as inhalation of sanding dust to ensure that I go out of my way to take these simple precautions. I suggest we all do the same.**

After you've made some carbon-fiber parts, you will be able to estimate what you will need without doing either. I decided on three layers of cloth cut into 1-inch strips. While cutting the cloth, also cut a few narrow ½- to ¾-inch-long scraps that you'll apply "cross-grain" near the axles and at the center; this will increase the strength of these high-stress areas. Be careful: any loose particles of carbon fiber will float around the workshop and create a hazardous environment. A respirator and a fan are very good ideas.

When all the carbon has been cut, dispense one pump each of resin and hardener into a plastic yogurt cup. Mix them thoroughly for about a minute.

Work with just one layer at a time when you lay up the landing gear. First, place the bottom layer of carbon on the curved surface of the mold and apply some epoxy. With the disposable brush, carefully work the resin into the fibers using a stippling or poking motion. Eliminate any air bubbles or voids. Be careful to keep the fibers straight, and fully saturate them with resin. It is OK to use a little excess epoxy at this point because it can be worked into the upper layers as you go.

***Completed landing gear with wheels. Harden the balsa locator block with thin CA.***

Now place the next layer of carbon on the form, and work any excess resin from the first layer up into it. If necessary, add more resin to fully saturate the new layer. Continue to add your layers in this manner, gently stippling the resin thoroughly into the fibers. Reduce the amount of resin you add as you get near the end of the layup process; when the fibers are saturated, any additional resin only adds weight and reduces strength. Vacuum-bagging helps to remove any remaining excess resin as well. When the top layer is saturated, apply the cross-grain fibers at the axle mounts and the center. If you are not planning to vacuum-bag the gear, set the mold aside and let the resin cure overnight.

### VACUUM-BAGGING

It is best to vacuum-bag the landing gear to achieve the optimum resin-to-fiber ratio. In addition to the vacuum pump, you will also need Peel-Ply*, bleeder material, some sort of plastic film and window-caulking putty. Peel-Ply is a Teflon-coated nylon fabric that allows excess resin to migrate out of the layup and into the bleeder material. In addition to absorbing excess resin, the bleeder material helps get all the air out of the sealed system. The air can easily flow in and around the fibers of this material and escape. Without the bleeder, one area of the mold can be sealed off from the rest, and this will prevent the whole mold from being in a vacuum. For small parts like this landing gear, you can just use a couple of layers of paper towels for the bleeder material. To seal a small, hard mold like this, it is easiest to use a plastic bag; in this case, a gallon-size Ziploc freezer bag worked well.

The actual vacuum-bagging process is quite simple. When you finish the layup, place a layer of Peel-Ply completely over the new part. Cover everything with the bleeder material, then slide all of this into the freezer bag. Before you close the bag, insert the hose from the vacuum pump, placing it against the side of the block. Make sure that there is some bleeder material around the end of the hose so that the bag will not get in the way. Close the bag's "zipper," and with some window-caulking putty, seal around the vacuum hose. Turn on the pump and seal any leaks. Pull as much vacuum as you can—ideally, 28 to 29 inches of mercury. Let it cure overnight.

***The complete layup in a vacuum bag. Notice that the vacuum tube is against the mold and that the mold and the tube are surrounded by paper-towel bleeder.***

### FINISHING UP

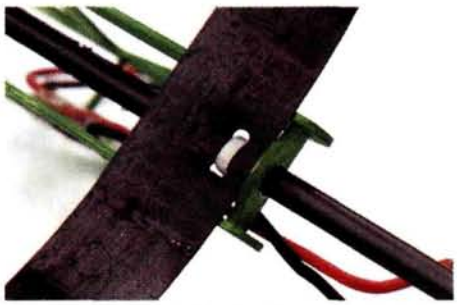
When your gear has cured, unwrap it, and pop it off the mold. Some cleanup will be necessary before the part is ready for use. I used a bench-mounted disk sander for this and a shop vac to control the carbon dust. You can use sandpaper mounted on a sanding block, but then you won't be able to control the dust. Be very careful! The dust created by sanding, grinding and cutting carbon fiber is a health hazard. Do not breathe any of it. I use a closely

## TOOLS AND MATERIALS YOU'LL NEED

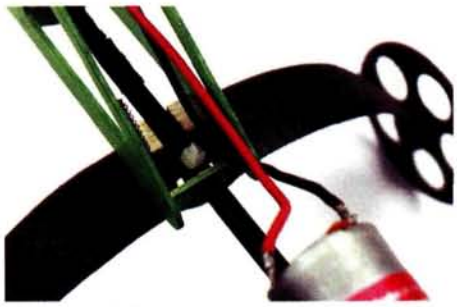
- 3-ounce, unidirectional carbon-fiber cloth.
- West Systems* or EZ-Lam* epoxy.
- Epoxy mixing cups and application sticks.
- A disposable 1-inch brush with the bristles trimmed down to ½ or ¾ inch.
- A pair of "shop" scissors to cut the carbon fiber.
- A scrap piece of pine 2x4, at least 8 inches long.
- MonoKote.
- Scrap balsa wood.
- 2-56, socket-head screws, nuts and washers.
- Wheels.
- A drill with a ¼-inch bit.
- Disk sander or sandpaper on sanding block.

### *To vacuum-bag your parts:*

- A vacuum pump.
- Peel-Ply.
- Bleeder material (paper towels will work for small projects like this).
- Sealing film or a gallon-size, sealable sandwich bag.
- Window-caulking putty.



***The underside of the landing gear that has been mounted to the fuselage. A small scrap of carbon was glued cross-grain between the holes to prevent splitting.***



***The top of the now mounted landing gear. Note wire tie and balsa locator block.***

fitting canister respirator and work outside in a breeze to avoid inhaling the dust.

After cleaning up the carbon fiber, drill the ends of the gear for axles. I used 2-56 socket-head capscrews, nuts and washers, and they were strong enough for a model as light as the Dragonfly.

Mounting the gear on the model was simple: I drilled two small holes in the top of each gear about ¼ inch from the center. After threading a small plastic wire tie through this hole, I cinched it around the center carbon tube. Note that the photos show the cross-grain carbon fiber at the center of the landing gear and where the axles are. This prevents the wire tie from splitting the gear parallel to the fibers. I shaped a block of balsa to fit between the sides of the plane and to cradle the tube fuselage. Medium CA will harden the blocks and will also attach them to your gear. The blocks restrict the side-to-side motion of the landing gear, and they also transfer some of the shock of landing to the center tube.

## CONCLUSIONS

My experiment was a complete success. Flight-testing determined that the CG shift was not significant for this model. The new gear even caused less drag than the original gear. The flat plate of carbon is less than 1/32 inch thick and has a much more aerodynamic cross-section than the round wire. Ground handling was greatly improved as well. The wheels maintain better alignment, and the wings are more likely to stay level in a crosswind and while turning. Harder landings just flex the gear a bit, but the plane doesn't bounce back up into the air. Repeated landings and touch-and-go's have proven this landing gear to be much more durable and sturdy than the original wire gear. Without my really trying to save weight, the landing gear weighs only 6.4 grams—just 0.2 gram more than the original music-wire gear. Another few seconds at the disk sander would easily remove that, but I'm having too much fun to take the model apart again!

What about larger and smaller models? The beauty of these materials and techniques is that you can scale the layups to accommodate any size of model. While the Dragonfly is the lightest model for which I personally have made carbon-fiber gear, you could easily make parts for smaller and lighter models merely by reducing the amount of carbon and epoxy used and resizing the mold to match your model. On the upper end of the scale, there are full-scale aircraft. A few years ago, I spent a number of hours fitting retractable gear to a homebuilt canard. Very similar to the famous Long-Eze, it, too, uses solid carbon and epoxy gear legs. Anything's possible with carbon fiber.

**Addresses are listed alphabetically in the Index of Manufacturers on page 142.*

MODEL AIRPLANE NEWS

FIELD & BENCH

# REVIEW

I was at the local flying field the other day—a field at which we often shoot the flight photos you see in *Model Airplane News*—when I overheard a club member named Dave (who, interestingly enough, was flying an ARF) make the unwittingly ironic statement, "I hate ARFs, but I hate crashing even more!" I can only assume that Dave meant he hated crashing a model he had spent a lot of time building. And so goes the love/hate relationship with ARFs that I've observed in some of us modelers.

I had another ARF surprise when I first flew Hangar 9's* Ultra Series ARF PT-19. I showed up at the 518th "Warbirds Over New York" in Albany—a very nice event, by the way—with my PT-19 and fully expected my IMAA-legal, scale ARF warbird to cause a stir (either negative or positive) because it was so new and had been on the market for only a week and a half. Much to my surprise, four (yes, four) other Hangar 9 PT-19s were there, too! I guess the scale buffs like to know that they, too, have the ARF option, even while they're working on their contest-winning pride and joys. Why, even my longtime friend Frank Tiano—Mr. Top Gun himself—has snagged a PT-19. Of course, as often as Frankie crashes, he should consider buying stock in the Acme ARF company.

The point is, whether or not you want to admit it, Hangar 9 has come out with a unique product—and one that flies extremely well to boot—that a whole lot of people want.

## THE KIT

The PT-19 is a 100-percent balsa-and-plywood model complete with built-up rib/spar wings and a slab-side fuselage with stringers for enhanced scale appearance. The wings, solid-sheet tail feathers and fuselage come covered in yellow and blue Ultracote*; the rudder comes trimmed in red and white Ultracote. The fiberglass cowl comes painted and is well matched to the Ultracote dark blue. The instruction booklet is one of the very best I have ever encountered. It's 56 pages long and has 176 photos and diagrams covering all assembly stages, which are supported by clear instructions. The booklet is divided into 18 sections for each phase of assembly. There's even a section that includes full-scale, 2-view line drawings in case you want to go all-out on detailing. Chances are, you'll like this model so much that you'll feel it's worth dressing up.

The hardware kit includes virtually everything you'll need, from the rudder pull/pull linkage to the different components needed for either ignition or glow-engine installation. Two fuel-tank stoppers are even included—one for glow and the other for gasoline (only glow-fuel tubing is included).

The three-piece wheels are also of good quality; too bad they're way out of scale for this model. They're 5.25 inches in diameter. True, the full-scale PT-19 has big wheels, but these are far too big for a slightly less than ⅕-scale model. I replaced them with Du-Bro's* 4.5-inch, lightweight treaded wheels, which look much better and are still large enough for even the roughest fields. They are light, too—only 3.68

# HANGAR 9 PT-19 ARF

## *Where no ARF has gone before*

*by Chris Chianelli*

***The PT-19 is piloted by Hobby Lobby ⅛-scale "Mary" pilots. I call them Bridgette and Erika; Bridgette is the redhead. I think the girls look marvelous! The rollover pylon comes assembled and painted and should do a great job protecting their pretty little heads.***

PHOTOS BY WALTER SIOAS

## SPECIFICATIONS

**Manufacturer:** Hangar 9

**Model name:** Ultra Series Fairchild PT-19

**Type:** ARF WW II scale

**Length:** 63.25 in.

**Wingspan:** 82 in.

**Wing area:** 1,009 sq. in.

**Weight:** 12 lb., 15 oz. (w/Du-Bro lightweight wheels)

**Wing loading:** 29.57 oz./sq. ft.

**Engine req'd:** 1.08 to 1.20 2-stroke, 1.20 to 1.50 4-stroke, or 23cc to 25cc ignition

**Engine used:** Saito* 1.50

**Prop used:** Master Airscrew* Classic 16x8, Graupner 16x8

**Radio req'd:** 4-channel w/5 servos (aileron, rudder, elevator, throttle)

**Radio used:** JR* XP652

**Fuel used:** Wildcat* 15% (14.4% synthetic, 3.6% castor)

**List price:** $329

**Features:** built-up, all-wood ARF; slab-side fuselage features stringer detail for scale-like appearance; wing is D-tube type with cap-strips. Kit includes painted fiberglass cowl, fuel tank, wheels, steerable tailwheel and complete hardware package.

**Comments:** a well-executed rendition of Fairchild's Army Air Force trainer that displays exceptionally smooth flight characteristics yet will do a full complement of aerobatics, including stall maneuvers.

**Hits**

- Excellent instruction booklet.
- Good parts fit and material quality.
- Excellent flight characteristics.
- Excellent in-flight visibility.
- Powerful scale impact.

**Misses**

- Included wheels are way off scale size.
- Instrument-panel decal is too large.

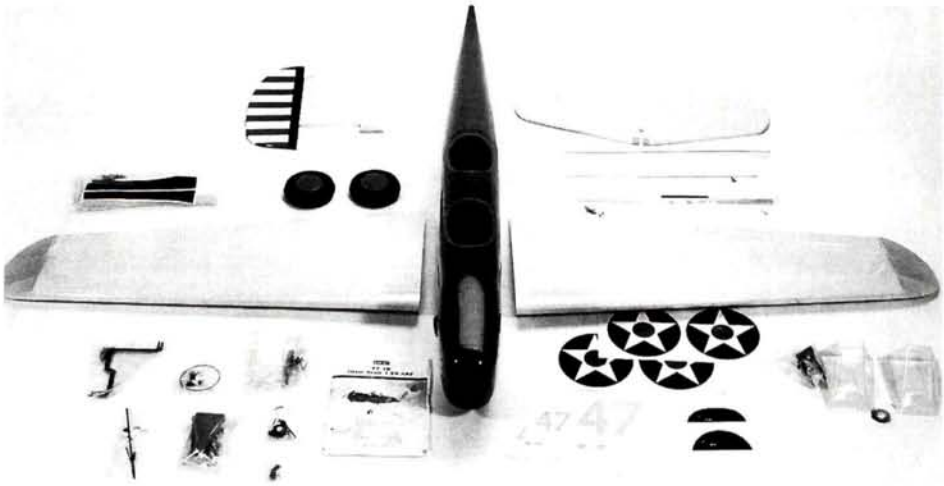
ounces each as opposed to the stock units that weigh 8.32 ounces each.

### ASSEMBLY

With 176 photos and illustrations accompanying well-written text, there's little point in my rehashing "glue part A to part B" here. It would be a waste of good magazine space, so I'll just cover some of the things I did differently and why I did so.

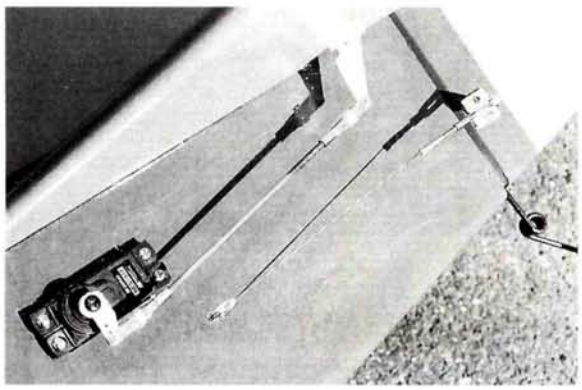
I've said it in other articles, and I'll say it again: I like two servos for elevator control. It's just a good safety precaution. When you have two servos on both the ailerons and the elevators, if any one of the servos in your entire airborne pack decides to quit, your chances of getting your model back down safely are still pretty good. Otherwise, if your servo quits and it happens to be the one and only one that controls both halves of the elevator, you'll be taking a long walk with a garbage bag, for sure.

This model has a long tail moment, and that's a good thing for stability and smooth pitch response, but it also means long control linkages and more potential for slop. I decided to place the elevator servos in the back of the fuse for nice, short, positive control-rod runs. With the slab-side fuselage, this modification was quite simple.

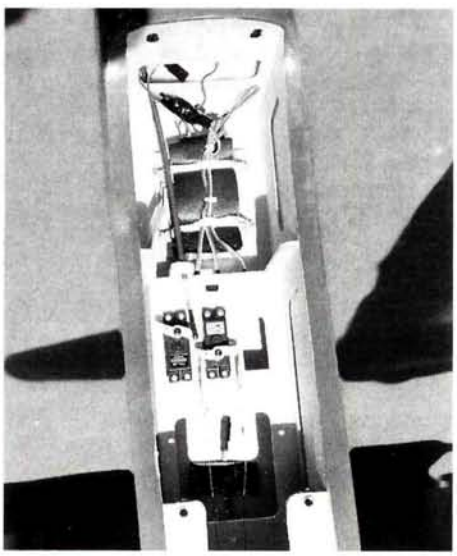


Of the six Hangar 9 PT-19s I have seen fly—mine, Frankie Tiano's and the four that were at the Warbirds Over New York meet—two suffered a loose main landing gear. One of them was way over-powered with a Quadra* 35. The fella told me that it was the only engine he had, but I do believe he really wanted to have the first 3D-maneuver-capable PT-19. Anyway, he needed so much tail weight to balance the model that it was pushing 20 pounds! It flew very well nevertheless, which is a testament to the design, but we'll discount his gear problems because he was more than 3 pounds over the 13- to 16-pound weight range. Another PT-19, this one powered by a U.S. Engines* 25, developed forward/backward play in one landing gear. Though I never opened up a wing on this model, I can only assume that some soft wood found its way into the vertical landing-gear blocks. Frankie and I poured thin Zap* into the grain of these vertical blocks, and we've had no problems. Of course, by the time you read this, there's a good chance that Frankie may have crashed his PT-19 due to an egregious pilot error—a *very* good chance. You might want to strengthen the landing-gear-block areas on your PT-19 with Zap before you fly; it certainly can't hurt.

This model is big, and so are its parts. In my estimation, this makes it easier to build than a small model, especially if your close-up vision—like mine—is not what it used to be. Large parts with an overall good fit make assembly a very pleasant experience. Oh, yes; there is one part that was so off, it didn't fit at all: the instrument-panel decal is way too big. Hmmm .... Maybe the wheels and the instrument-panel decals are from a *¼-scale* ARF PT-19 that Hangar 9 is secretly planning for the future; what do you think? Anyway, if you have to have one part that doesn't fit, I guess an instrument-panel decal would be among the least annoying.



***Above: the instructions show one elevator servo in the radio compartment, but I opted to put two elevator servos in the tail for short, positive control rods and less potential slop and flutter. The rudder pull/pull system is supplied with the kit. Below: with only a rudder and a throttle servo, the huge radio compartment looks barren.***



### POWER

The question of power for this design is a really good one. A model that is fairly

*Continued on page 46*

## CREATE A NOSTALGIC NOSE

**A finishing touch that really completes the scale look is the addition of a Tru-Turn* prop hub. These hubs not only look great, but they are also available with a two-nut locking system. If you love large-bore, single-cylinder 4-strokes, as I do, they are a must. Although I've never had kick-back problems with any of my Saito 1.50s, they can occur with any 4-stroke, especially if it's run too lean. Once I lost my prop, spinner, washer and shaft nut in flight because of a kick-back (not a Saito, by the way). All the parts went sailing into oblivion, my plane ditched short of the field and my flying day was finished. With Tru-Turn's locking system, this isn't likely to happen. Tru-Turn offers hardware for almost any engine. The Saito calls for 8mm gear.**

**To round off the nostalgic nose, a 16x8 Master Airscrew Classic series prop is the perfect match for the PT-19 and its polished-aluminum nose.**

# FLIGHT PERFORMANCE

I took the PT-19 to Warbirds Over New York, and there I met my longtime friend and toughest critic, Nick Ziroli. I thought, "What an opportunity: a flight test of the first giant-scale ARF warbird and an afternoon with Ziroli, all at the same time, in the same place!" We both looked over the PT-19, and considering its size, weight, wing area and moments, decided we probably had a good flyer on our hands. That turned out to be an understatement. Nick took the transmitter, and I took some pictures—none of which, by the way, were good enough to make it into this article. We have our in-house photographer, Walter Sidas, to thank for these fine photos.

**• TAXI AND TAKEOFF**

Nick taxied out onto the grass runway, turned the model into the wind and held it there for a moment. This is one beautiful airplane. The 1/5-scale blonde and red-haired pilots, Erika and Bridgette, made the nostalgic picture absolutely perfect. Nick advanced the throttle evenly, let the tail come up, did a fairly long rollout, and the model broke ground—seemingly, of its own volition. Because of the long tail moment, only a little right rudder was needed to compensate for engine torque. Nick had flown the pattern only twice when he exclaimed, "Wow, is this thing smooth! What a nice-flying model!" Nick wouldn't let me print his words if they weren't true. If I dare to misquote him, I'll hear about it until Y3K!

When I took it up, I noticed that if you're up on the mains on a takeoff run and you goose throttle, you'd better be ready to apply a bit of up-elevator to compensate for the engine downthrust. This probably won't be necessary if you fly off concrete, but if you fly off grass, as we did, there's more rolling resistance and you may need to apply a little up-elevator; the PT-19 responds instantly to this technique. If your grass field is short, it may be necessary to goose the throttle at times. But if you have a long field, use its length because the PT-19 does the most beautiful, scale-like lift-off and stable fly-out you've ever seen.

**• AEROBATICS**

Nick and I each did some of our favorite maneuvers. He did some slow, slightly barreled rolls and some not-so-slow, more axial rolls and a beautiful knife-edge—not one of my better maneuvers. We both wondered whether it would spin, since it is so stable. I took it upstairs, chopped the throttle and dumped it over to the left. It did a very scale-like spin—almost slow motion when compared with the fast spin of a smaller model. Then I performed two of my favorites: Cuban-8s and, as you can see from the photo, low inverted passes that needed only moderate down-elevator input. This model will do almost any maneuver in a very graceful, full-scale sort of way. With the powerful 1.50, vertical performance was very good, albeit very non-scale-like. I don't think you'll see a full-size PT-19 do a tall top hat anytime soon!

**• LANDING**

With 82-inch-long, bright yellow leading edges, this model has to be one of the easiest to see on final approach that I've ever flown. The PT-19 really does make you look like a better pilot than you really are—at least, that's true in my case. I've never been a 3-point-landing king like some people I know, but I was able to do quite a few of them over the two-day Warbirds event. Rudder response was particularly good all the way to touchdown. I haven't had it out in a crosswind yet, but I'm certain the PT-19 will hold its own quite well. With a larger-diameter 17 or even 18x6 prop (which the broken-in Saito will handle without any problem) for added braking, the PT-19 will operate at smaller fields just fine despite its size.

Combine the PT-19's large size and bright colors with its graceful, predictable flying characteristics, and you have one very relaxing model to fly—a total joy. When I asked Nick to supply a few adjectives, he quickly rattled off "Smooth, groovy and responsive." Not only is the PT-19 aerobatic, but if you also want to start practicing scale-like flight—the kind of in-flight realism that earns you big flight points at contests such as Top Gun—the PT-19 is the perfect answer. Moreover, considering its "no surprises" stable nature, I feel that with the control surfaces set up conservatively, this big beauty could easily serve as a first "low-winger" for an advanced novice. The PT-19 really is that good—and Nick agrees.

## THROTTLE OPTION SWITCH

If you would like the extra power offered by the Saito 1.50 for such times as when you're flying from a small field where the additional muscle would come in very handy, but you would also like to practice longer, scale-like takeoffs at larger fields, then this little throttle-governor program will give you that option with the flick of a switch.

This program gives you the desired amount of partial throttle when the throttle-transmitter stick is in the full position. Half to 3/4-throttle takeoffs with the P-19 are a beautiful sight. It is so scale-like and, in my opinion, it will make you a better pilot. There is just something terribly incongruous about a pretty scale model being horsed off the ground and climbing out at a 60° angle. If, however, you need the extra horsepower to get out of a tight spot, just hit the switch and you're there—instantly!

Since I'm something of a computer idiot, I'd like to thank Eric Meyers of Horizon for helping me out on the technical end.

Programming a switch-operated "governor" with your JR XP642 or XP652 is a snap. To pull off this bit of electronic wizardry, you're going to use one of the three available program mixes to mix the throttle channel to itself. Here are the basic steps:

1. Scroll through the modes to MIX A (it looks like MIX A11).

2. Push "channel" once to the "offset" screen. Move the throttle stick to low then push the "+" sign to establish an offset of approximately -83.

3. Push "channel" twice to the screen that lets you choose the switch that will activate your governor (I'd recommend "F1," the upper right-hand switch).

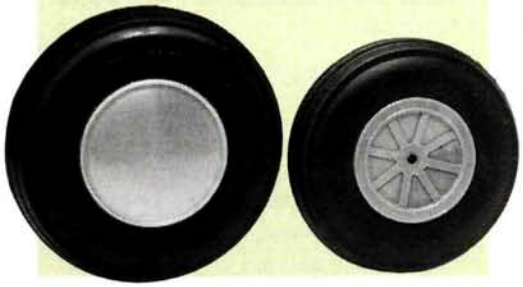
4. Push "channel" again, pull the switch toward you, put the throttle to high, and enter a value that closes the throttle the desired amount (-25 is a good place to start). Vary this value to adjust the amount of throttle reduction.

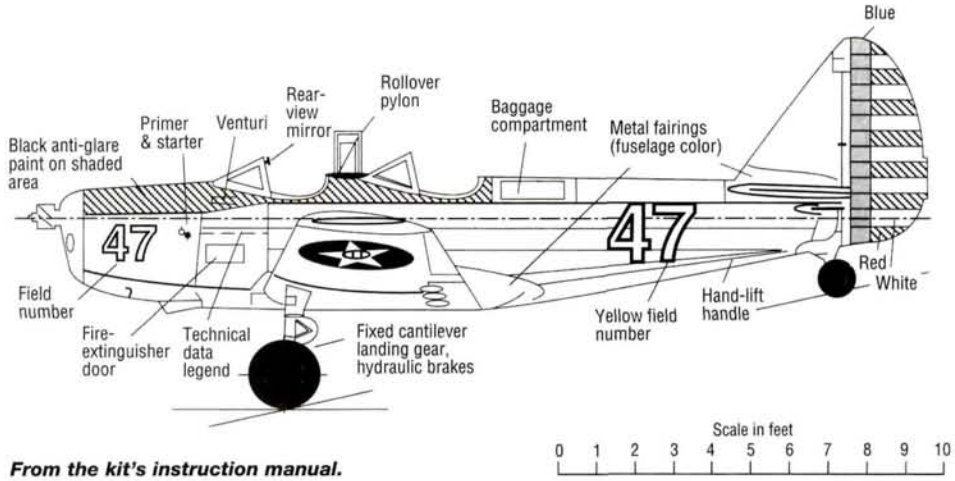

It's easy to make your computer radio work for you; it will make your flying easier and more scale-looking. Remember, anytime you want full power, just push the switch forward, and you'll be back to normal!

## SCALE TOUCHDOWNS

The PT-19 is such a nice flying, good-looking model, it seemed a shame to support all its beauty on bare music wire and wheels that were so oversize, they looked silly. This is a great model, and it really deserves a set of Robart's* scale Robo Struts. Bob Walker of Robart told me that they are gearing up (no pun) to produce this strut; it should be available by the time you read this.

The wheel on the left is the stock Hangar 9 5.25-inch unit; on the right is a 4.5-inch Lightweight Treaded wheel from Du-Bro. The Du-Bro wheels not only look great and are the right size, but the set also weighs 9.28 ounces less than the stock set. Don't get me wrong; the stock set is of good quality, but they're just too much for this model. The PT-19 looks so much better sitting on Robo Struts and wheels of the correct size.






***From the kit's instruction manual.***

## UPSIDE-DOWN SAITO

I'm often asked if it's a good idea to run a specific engine inverted. The fact is, some simply handle it better than others. To an engine such as the Saito 1.50, it seems to make no difference at all. As of this writing, I've logged 17 flights with the PT-19, and it has yet to flame out; not once has it quit.

The first thing I do with a 4-stroke, especially if it's going to be run inverted, is replace the stock glow plug with an O.S "F" plug. I can find nothing that works better in a 4-stroke engine, no matter which brand it is. I have heard good things about K&B's* 4-stroke plug but haven't had a chance to test it. I've heard rumors that another company is going to come out with a 4-stroke plug, but nothing has been confirmed. With this setup and a Graupner* 16x8, the 1.50 turned up 8,800rpm (with an APC* 16x8, expect about 9,200 to 9,300rpm) and idled very reliably at 2,100 to 2,200rpm; very impressive for an inverted installation.

The 1.50—or for that matter, any 1.20—is a perfect fit in the PT-19 cowl. I did use a Saito optional flex pipe to route the hot exhaust outside the cowl. The cowl is so big that the stock muffler ends inside it; you can use rubber extension tubing, but I've had those things fall off.

Though the engine box comes predrilled for the included aluminum, glow-engine motor mounts, it needs to be coated with epoxy. Some drilling is necessary for ignition engine installation, but it's a fairly simple procedure. As you can see from the photo, I placed the 1000mAh battery on top of the engine box. That was the only balancing I needed to do to obtain the correct CG.

strong, weighs in at 12.53 pounds and has 1,009 square inches of wing area enables you to have a lot of power options. I used the Saito 1.50 because that's what Horizon Hobby*, Hangar 9's distributor, sent me. Although this engine is probably my favorite big-bore, single-cylinder, sport/scale 4-stroke engine of all time, I probably would not have chosen it for the PT-19. This model just doesn't need quite so much power. Is the model strong enough to handle the power? Definitely. Is it needed? Definitely not. Any 4-stroke 1.20 of average power will do perfectly. Remember, the Saito has above-average power and way above-average big-prop-swinging torque. A strong .90 2-stroke will fly this model OK, but you'll have to add nose weight. I had to add none. Three of the models at the Warbird meet were powered with ignition engines. I've already told you about the over-powered 19-pound "pylon racing" version; the other two used a Zenoah* G-23 and a U.S. Engines 25; either is a great match. For you 2-stroke-only guys, an O.S.* 1.08 would be really nice, too. As I've said, the PT-19 gives you many choices.

### CONCLUSION

I don't think anyone has ever offered an IMAA ARF Cub in military colors, so that would make the PT-19 the first IMAA-legal ARF warbird ever offered. In an industry that can be overly conservative, I feel the Hangar 9 guys took a chance here, and it has paid off—not only for them, but for us, too.

A friend of mine who owns a large hobby shop ordered six of these kits. They came in on a Friday afternoon, and by Saturday morning, only one was left. Apparently, we modelers love Hangar 9's PT-19, and it's safe to say that we want more of this type of model—larger ARF warbirds. So where do you go after primary training? If you were in the Army Air Force in the early 1940s, you were sent to advanced training. How about an 82-inch-wingspan ARF Texan from Hangar 9? Or for that matter, from any other manufacturer who might be interested in selling lots of kits?

**Addresses are listed alphabetically in the Index of Manufacturers on page 142.* ✈

**NEWS FLASH!!!**

# '30s FLYING LEGEND RETURNS. GIANT-SCALE PILOTS ELATED!


**Wingspan:** 100.5 in (2550mm) • **Wing Area:** 1487 sq in (95.9 sq dm) • **Weight:** 16-25 lb (7260-11340g) • **Wing Loading:** 24.8-38.7 oz/sq ft (76-118g/sq dm) • **Fuselage Length:** 67.8 in (1720mm)
**Requires:** 4-5 channel radio with 6-8 servos, 2-stroke 1.08-1.99 cu in (17.5-32.5cc), 4-stroke 1.2-1.6 cu in (19.5-26cc), or 25-35cc (1.5-2.0 cu in) gasoline engine, glow fuel, glow starter and support equipment.

GOLD GIANT SCALE EDITION™

Between the dark days of the Depression and the "Big One," an aviation legend was born. The SR-9 was a class act, a plane built by craftsmen and graced by good looks, yet designed for no-nonsense practicality. Executive charter companies loved its up-to-date comm and nav gear, and ability to carry 4-5 businessmen in style. Individuals bragged about its mellow handling and the crafted quality it offered. But like most legends, the SR-9 eventually faded from sight, never to return...

Until now.

With its massive, 100.5" wingspan, the SR-9 not only qualifies as Top Flite's biggest plane ever, but as its most *scale* Gold Edition™ plane as well. Plans scaled from excellent 3-views provide design detail on everything from the bold cowl to the graceful wing to the small, gold-accented bow & arrow logo on the tail. It's a scale modeler's kit, pure and simple, the one by which all other sport scale kits will be judged. Preformed ABS parts do much of the shaping labor for you: the cowl, wheel pants, fairings—even the tiny inspection plates. Included wood pieces shape the landing gear struts, providing form without work.

And now as then, the SR-9 is a *craftsman's* plane. TLC and patience are required to bring out its best, even with Gold Edition™ engineering to assist.

The bottom half of the stick-built fuselage builds flat on the board, as does the interlocking, I-Beam, multi-spar wing. Each wing section features built-in flaps, plus servo mounts for all control surfaces on that side. Wing sections slide onto an aluminum tube and attach with wing bolts, accessible from inside the cabin. Opening doors on both sides offer easy access to the bolts, and an easy way to install the (optional) cabin kit.

Once the craftsman's work is done, however, the pilot's fun begins. Rock-solid on the sticks, the SR-9 is docile with a 1.08, peppy with an O.S. FT-160, and breathtaking with a SuperTigre® G-3250. Dual elevator and aileron servos provide the response and muscle; an airfoil that blends from a modified "Clark Y" airfoil at the root to a Selig 3086 at the tip keeps stability up and tip stalls down.

All this—and a modest price, too—make the Top Flite SR-9 one of the neatest things since sliced bread. For the location of the dealer nearest you, please call 1-800-682-8948 and mention code number 0228Z.

**A 2-piece, plug-in wing provides a practical solution to transportation realities, and reinforcement to an already strong wing attachment system.**


**Just as the full-size SR-9 was in its heyday, Top Flite's 100.5" span version offers larger-than-life looks blended with solid, powerful performance.**

Distributed Exclusively
Through Great Planes Model Distributors Company
P.O. Box 9021, Champaign, IL 61826-9021

*For more information on Top Flite products, see the web site at:* **www.topflite.com**

# PRODUCT WATCH

*Editors' picks of the month*

**AT MODEL AIRPLANE NEWS, we not only tell you what's new, but we try it out first to bring you mini-reviews of the stuff we like best. We're constantly being sent the latest support equipment manufacturers have to offer. If we think a product is good—something special that will make your modeling experiences a little easier or just plain more fun—we'll let you know here. From retracts and hinges to glow starters and videotapes, look for it in "Product Watch."**

HOBBICO

## Hot-Shot 2

### Do the twist

Where do all those glow-plug igniters go? Does a covert team infiltrate the pit area and systematically remove them from our flight boxes? I subscribe to the theory that in every flying club, there's one guy whose Ni-starter collection now exceeds 100. For whatever reason, the odds are that you'll need to buy a new igniter sometime, but there *is* a silver lining: you can now buy the new all-metal Hot-Shot 2 from Hobbico. Hobbico's former spring-cylinder clamp design has been replaced by one that has a stronger "twist-and-lock" sleeve that holds the glow plug more securely and leaves you with one hand free when you start your airplane,and it's less likely to vibrate off the plug during warm-up. The Standard Hot-Shot 2, available in "regular" and 3-inch shaft lengths, comes with a rechargeable Sanyo 1500mAh cell; the Super Hot-Shot 2 has a 4000mAh cell (higher capacity). Both units come with a 110V "overnight" wall charger and an end cap that protects the electrical contacts from dirt and corrosion. Unfortunately, the one-year warranty doesn't cover loss from theft! *—Bob Hastings*


Standard Hot-Shot 2—part nos. HCAP2520/ HCAP2522 (regular shaft/3-inch shaft); $25.99/$29.99.
Super Hot-Shot 2—HCAP2528; $39.99.
**Hobbico**; distributed by Great Planes Model Distributors, 2904 Research Rd., P.O. Box 9021, Champaign, IL 61826-9021; (800) 682-8948; fax (217) 398-0008; www.greatplanes.com.

DU-BRO

## Remote Safety Igniter

### Got a light?

I really enjoy the small challenges that come up while building RC models. In putting the finishing touches on my ⅛-scale Hobby Hangar Gee Bee Z, I needed to provide glow-plug power to the 4-stroke beneath the cowl. I had planned to drill a hole to accommodate a long-shaft Ni-starter. Unfortunately, with the engine orientation that I chose, a cowl hole of that size and position would obliterate a significant portion of an important decal. The ideal solution was Du-Bro's Remote Glow Adapter. This extension has 2 feet of wiring—more than enough to run the length of the cowl and go into the fuselage. There's only one hole to drill for the nearly flush-mounted igniter receptacle and one grounding eyelet that is attached to an engine-mount screw. The glow-plug connection is a scissor-style clamp that is hooked onto the plug's center pin. The visible portion of the all-black remote has a small finger grip that makes it easy to swing open the unit's protective sliding cover. The igniter receptacle accommodates all of the popular glow starters I've tried. It's a good-quality unit that adds a nice finished appearance to your model; and the icing on this piece-of-cake installation is that you can pick it up for $8.95. Part no. DUB793. *—Bob Hastings*

**Du-Bro Products,** P.O. Box 815, Wauconda, IL 60084; (800) 848-9411; fax (847) 526-1604; website: www.dubro.com.

GREAT PLANES

## Prebuilt Bench Topper

Conquer that clutter

This workbench organizer could be your first step in conquering the pile of parts and tools that covers your workspace. This all-wood, 15½x7¼x 5¼-inch box is prepainted with white epoxy and has storage for all of your most-used tools and accessories. Your epoxy bottles go right alongside mixing cups in their correct-size compartments, your screwdrivers fit in specially made slots, and T-pins rest safely on the attached sponge material. The Bench Topper also includes shallow and deep bins for tools, glue and so forth, three drawers for different odds and ends and even a slot for the disposal of old hobby-knife blades! Simply pull the Topper out of the box, and it's ready to be placed on your bench or hung on the wall. Price—$34.99.

*—Geoff Cozine*


**Great Planes Model Distributors**, 2904 Research Rd., P.O. Box 9021, Champaign, IL 61826-9021; (800) 682-8948; fax (217) 398-0008; www.greatplanes.com.


SKS VIDEO PRODUCTIONS

## 9th Annual Skymasters Float Fly Video

Pontoon power

SKS Video has truly captured the essence of RC modeling with its latest offering. In addition to featuring the best runs of the day and the best planes, it shows a fair cross-section of the more than 100 contestants entered in this event. You'll see everything from a Wingo on floats to Charlie Viosca's ⅓-scale Super Cub, which was reviewed in the June '98 issue of *Model Airplane News* and further explored in his "How To" article in the January 2000 issue. Instead of using a narrator, SKS lets the pilots talk about their planes. Although there are problems inherent with non-scripted dialogue, you get an inside look at a number of models. What did the pilots like about their planes? What modifications were made and why? Because they speak openly about their models, you hear what is of special interest to the modelers—not the narrator. Whether you're considering float flying or are already immersed in it, this video is a great choice. If you pay close attention, you'll see a large fish jump out of the water near a plane
landing , which reminds us that our hobby involves outdoor enjoyment in addition to the pleasures of modeling.Price—$19.95 (plus $3.25 S&H).

*—Geoff Cozine*

**SKS Video Productions**, R.D. #1, Box 264, Pine Rd., Abbottstown, PA 17301; (800) 988-6488; fax (717) 259-6379; cwww.yourkpa.com/sks.


DREMEL

## Professional Series 398

Not the same old grind

One of modeling's "gotta haves" is Dremel's Rotary Tool.

We all have different interests within the hobby, but if there's one common bond shared by RC modelers, it's our fondness for tools. If anything makes modeling more enjoyable, sign me up! Whatever part of a project you need to drill, cut, polish, sharpen, or grind, there is an attachment perfect for the task. A couple of things about the Dremel 398 variable-speed model set it apart from other rotary tools. You can adjust the tool in 1,000rpm increments from 5,000 up to 30,000. When you are working with tough materials like plastic and music wire, the tool doesn't bog down (compensated by the electronic feedback controller). Instead of it torquing abruptly in your hand when you switch it on, the tool's "soft start" means it slowly spools up to your selected speed. The 398 model costs about $100 and includes several bits. Accessories can be bought separately to tackle whatever tasks you need to simplify.

*—Bob Hastings*

**Dremel Tool,** 4915 21st St., Racine, WI 53406; (414) 554-1390. fax (414) 554-7654.

**Manufacturers!** To have your products featured here, send them to **Model Airplane News,** attention: Product Watch, Air Age, Inc., 100 East Ridge, Ridgefield, CT 06877-4606 USA.

# ELECTRIFY

## THE KYOSHO SUPER STEARMAN ARF

*by Tom Hunt*

MODEL AIRPLANE NEWS
**HOW TO**

***A perfect candidate for glow to e-power conversion***

For some time, electric modelers have thought of ARFs as heavy, poor performers. However, things seem to be changing with the Kyosho* Super Stearman. This model has a well-designed, lightweight structure that makes it a perfect candidate for e-power.

In the November 1999 issue of *Model Airplane News*, Chris Chianelli reviewed this model in its glow configuration. The model consists of all-balsa construction, with only enough ply to add strength where it's needed. It is completely covered, ready for radio- and power-system installation after the tail has been glued on, and the wings halves are assembled.

The fiberglass cowl and wheel pants are light and durable. The aluminum landing gear easily supports the slightly higher weight of the electric-powered version. The high-temperature covering material used on the model is similar to MonoKote, and although it is not the lightest available, a model this size does not warrant using the lighter, softer, more easily dented low-temperature coverings. Painted, 1/16-inch birch ply could be substituted for the aluminum N-struts and cabane struts, but if that's all you were going to do to lighten the model, it would translate into only an ounce or two of savings.

Just to let the cat out early, the model weighed 7 pounds, 2 ounces ready-to-fly with 16, 2000mAh cells on board. This is only about 1¼ pounds more than Chris's glow version. This brought the wing loading up to 22.9 ounces per square foot from 18.5. As you will read later, this is not a problem. If I had designed and built this model from scratch, I doubt it would have weighed less than 6½ pounds with the same equipment installed. There is a fair amount of extra balsa wood in the fuselage and wing, but the tail is as light as I would care to make it.

### CHOOSING A PROPULSION PACKAGE

When deciding what I'll need to power a potential electric model, I start by choosing an acceptable "do not exceed" wing loading. For this semi-scale biplane, I chose 25 ounces per square foot. The model's wing area is 717 square inches. Computing the maximum weight, we get approximately 7¾ pounds. Using a minimum 60 watts per pound (for scale-like aerobatics), we need to input 465 watts to power the Stearman. Let's set the maximum current at 30 amps for takeoff and full-power aerobatics. This now tells us to use 16 cells (cells = watts ÷ amps).

Before we select a motor, we should first decide what size of prop we would like to swing. I always start with one that has a diameter as near to scale as possible, if not slightly larger—especially on scale models. Scale size will give the best compromise of climbing power, speed and duration. A diameter of 14 to 15 inches would be "scale" for this model. I chose to go with a 14-inch; it allows room for growth if I need it. I don't like to swing a prop with a pitch that's less than half the diameter; I generally prefer the pitch to be between 0.6 to 0.75 the diameter. This, again, is a compromise between climbing, speed and duration. I settled on a 14x8 prop.

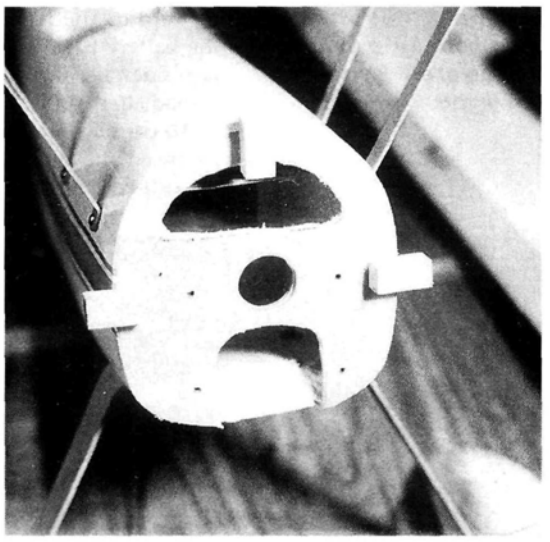
Now, 16 cells. Which motor works well on 16 cells and can swing a 14x8 prop at 30 amps? A few choices come to mind. An Aveox* brushless motor on a Robbe* planetary gearbox would be nice; an AstroFlight* 15 on an Astro Superbox might do it, too. I decided on the Modelair-Tech* H-1000 belt drive combined with a DeWalt 14.4V power-tool motor. This system can be run on as few as 14 and as many as 21 cells. It is available in three ratios: 3.07:1, 3.33:1 and 3.63:1. On 16 cells and the 3.07:1 ratio, this setup will swing the intended 14x8 prop with 29 amps. This system is a bit heavier, but it turns out that the weight was an asset. To get the CG in its proper place, I needed to shove the 16-cell pack as far forward as I possibly could. If I had used a lighter motor system, I would have needed to add lead to move the CG forward, and this would have negated any weight savings I'd gained.

### DRIVE SYSTEM INSTALLATION

The firewall on the model is quite robust. It's made out of what looks like 6mm birch ply, so it's more than sufficiently strong to take the 460 or so watts from the electric motor drive system. The H-1000 belt drive is usually mounted on beams like a glow engine. I used the glass-filled T-beam mounts that were supplied in the kit and shortened them a little with a band saw. I screwed the H-1000 to the T-beams and then screwed the beams to the firewall. The firewall had to be cut to clear the back of the motor and to provide cooling air to the battery pack. This was easily done using my Dremel* tool with a router bit and, later, a sanding drum. To keep the entire drive system inside the cowl, I elevated the prop shaft only about 3/16 inch from the center of the cowl (barely noticeable on the ground or in the air). I then mounted the cowl as per the instructions, with the exception of removing the lower centerline mounting block because it would interfere with the motor.

As I mentioned before, the 16-cell, 2000mAh battery pack (two, 8-cell "flat" packs, one on top of the other) had to be placed right up against the firewall to achieve the proper CG. I removed the factory-installed bulkhead in the lower wing bay to facilitate the installation of this pack. I used the convenient internal "deck" in the roof of the fuselage to mount the pack. I placed hook-and-loop fastener inside the fuel-tank bay on this deck to support the front of the pack. The rear of the battery sticks into the lower wing bay—perfect for getting at the connectors and for mounting the batteries. At this end, I used 8-inch-long hook-and-loop strap fasteners. I glued one strap into the roof of the fuselage with epoxy, placed the battery pack in the fuselage and wrapped the strap around the pack. I then added a second strap over the first.

I gave the model a couple of low-altitude drop tests to see if the straps would hold. They did ... in my shop. Out



***Here, the drive system has been removed to show the modifications to the firewall. The firewall has been cut to allow cooling air to pass over the battery and to make room for the rear of the motor. The round, factory-drilled hole in the middle was intended for the glow-fuel tank.***

## SPECIFICATIONS

**Model name:** Super Stearman

**Manufacturer:** Kyosho

**Distributor:** Great Planes Model Distributors

**Type:** ARF scale biplane

**Length:** 39 in.

**Wingspan:** 49.4 in.

**Wing area:** 717 sq. in.

**Weight:** 7 lb., 2 oz.

**Wing loading:** 22.9 oz./sq. ft.

**Motor used:** DeWalt 14.4V on Modelair-Tech H-1000 belt drive (3.07:1)

**Prop used:** 14x8 Zinger*

**Battery used:** 16 RC-2000s

**Radio used:** Futaba* TX/RX, 4 FMA S-100 servos (2 aileron, rudder and elevator)

**ESC used:** Gordon Tarling MS-40HV

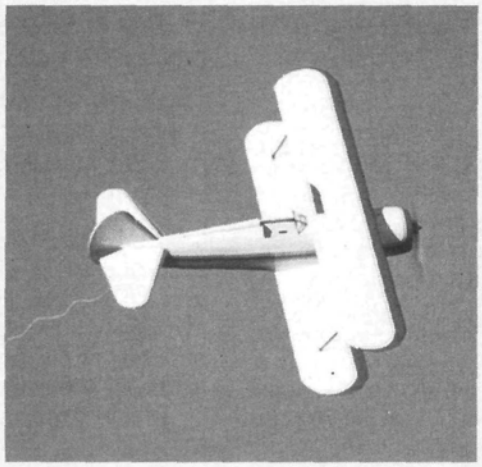
**Comments:** the Super Stearman is well-built and light, and it's an excellent candidate for electric conversion. With a few modifications, you'll have a terrific performer without any messy fuel residue!

***Cowl removed to show drive installation. The beam mounts are supplied with the kit and are ideal for the H-1000 belt drive. The wood blocks are for the cowl screws.***

## FLIGHT PERFORMANCE

Bright skies and low winds; I couldn't have asked for a better day. The 16-cell pack had been charged overnight, but I topped it off at the field to make sure. After a rollout of only 50 or 60 feet, the model began to climb out quickly. Only a small amount of right rudder was needed during rollout but was not required once the Super Stearman was in the air. I made a "trim lap" around the field. I don't remember moving any of the trims more than one or two clicks. I then began the passes for the cameras.

After four or five passes, I climbed for some altitude to start some aerobatics. First up: a loop. Although I probably didn't need to, I dived the model slightly, advanced to full power and pulled back on the stick. The plane tracked very straight through the loop with only a little rudder required to keep the heading. Once I leveled out at the bottom of the loop, I immediately suspected something was wrong. The elevator was now much too sensitive. Suspecting that the 16-cell pack had shifted, I immediately entered a long pattern back to the field, keeping the nose down and the bank angle low. I landed on the field without incident, although I was very close to snap-rolling. After removing the lower wing, I found my suspicions were correct. As I mentioned earlier, the Velcro®-brand fastener strap epoxied to the roof deck pulled the grain right out of the wood! I repaired the model, recharged the pack and flew my Stearman twice more that day and again the next.



The model flies quite scale-like through every maneuver I tried. Rolls are slightly off axial; snap rolls are sluggish in the beginning and quick to exit. Quite often, I got 1¼ snaps before I got used to the control inputs required. The extra mass of the motor battery is probably responsible for this. Split-S's, Immelmann turns, inverted flight, stall turns and even torque rolls are all possible with this model and the electric power. Flights were typically around 5 minutes and usually included all of these aerobatic maneuvers and a few touch-and-go's, too. One flight was well over 7 minutes, with a lot of time at a cruise power setting. This model cools the motor and batteries exceptionally well. The motor was always stone cold when I landed, and the battery only warm.

*Editors' note: if you want to see how well this plane handles with electric power, check out www.modelairplanenews.com for a video of the electric-powered Kyosho Super Stearman in flight!*

at the field on the first flight, they didn't! The wood failed under the strap! The straps didn't come undone; the straps didn't fail; the epoxy pulled the grain right out of the wood! It seems that the wood was too soft to take the large load. Installing a plywood doubler—even one 1/64 inch thick—to spread out the load would solve this problem. Make it about 2 inches square. To solve the immediate problem of a now-loose pack in the model, I placed a small piece of scrap Styrofoam between the lower wing and the battery pack. Even after I fixed the "roof" problem, I still put the small piece of foam in as insurance. I also put a false former in the fuselage just aft of the battery to ensure that the pack would not slide aft, even if it came off its mount.

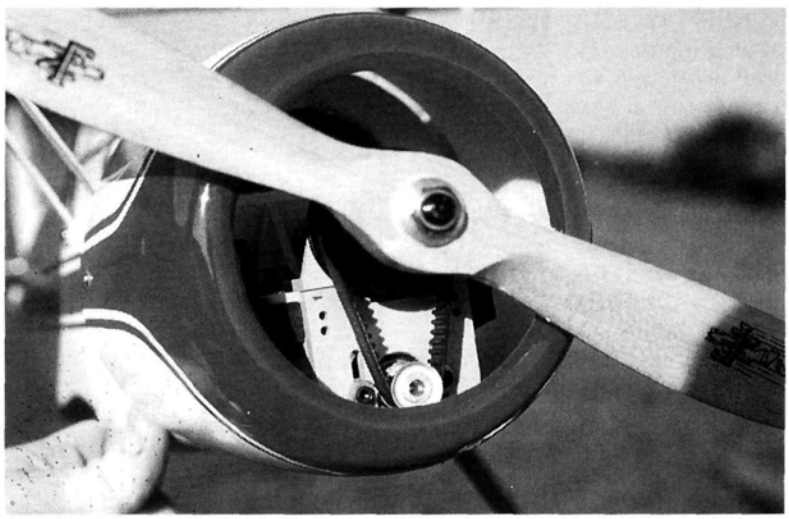
It is not unusual to have to remove the wing of an electric model to gain access to the battery pack for removal or charging. The bipe configuration makes this a little more work. Surprisingly, though, removal of the wing does not pose a big problem. At the field, I simply remove the bolts from the N-struts at the lower wing, invert the model, remove the wing bolts, and off it comes. The cabane struts, which are attached to the upper wing, easily support the weight of the model.

### RADIO INSTALLATION

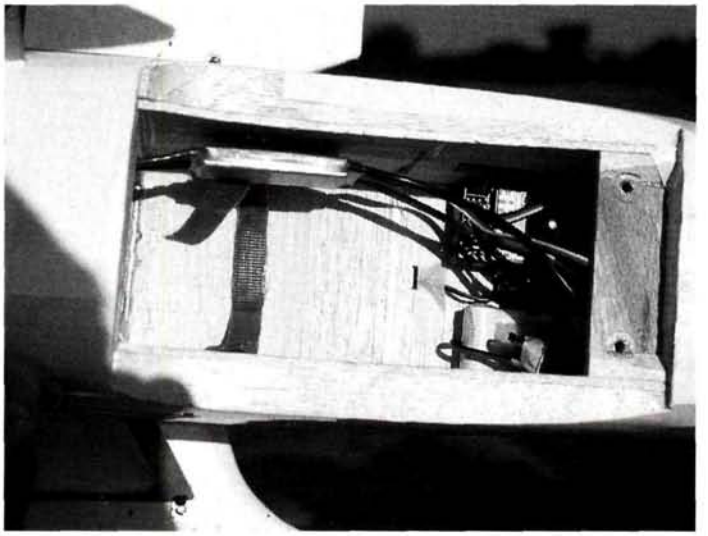
Per the instructions, I installed the aileron servos (FMA* S-100s) in the wing. I decided to mount two S-100s in the aft fuselage for the rudder and elevator. Since this was a "clean" aircraft (read: no gooey fossil-fuel residue), exposed servos would not be subjected to a harsh environment. I cut away the sidewalls of the fuselage to install the two servos, one on each side. I also doubled up this section of the fuselage with spruce to accept the servo screws. You'll need other balsa fillers because the aft part of the fuselage is mostly "stringer" construction. I installed short, direct pushrods from the servos to the control horns. No; I do not think putting these servos in the aft fuselage contributed to the CG problem. The tradeoff is to put the servos in the bay under the lower wing as indicated in the instructions and to use the heavier steel and wood pushrods. I think I actually saved weight and minimized the CG problem; the drive system I chose made it inconsequential.

I put the receiver and 270mAh battery pack on the roof deck in the fuselage just aft of the 16-cell motor pack; this is where the servos usually go. The electronic speed control (a Gordon Tarling* MS-40HV) lies forward of the receiver, along the side of the battery pack on the "false" inside fuselage sidewall. An Astro 204D ESC would be a good alternative.

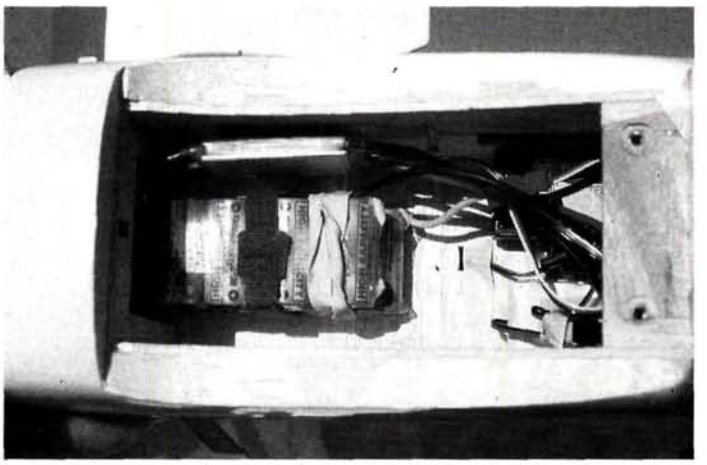
To complete the rest of the model, I just followed the instructions. You'll need to cut exit cooling holes in the lower aft fuse-



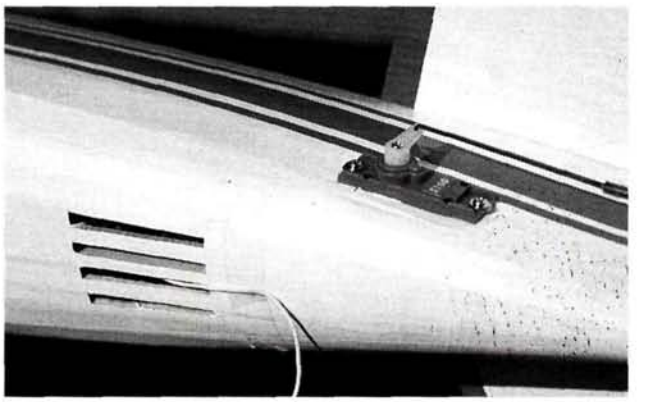
***To improve the model's appearance, a lightweight dummy radial engine could probably still be installed in front of the H-1000/DeWalt belt-drive system. A 14x8 Zinger prop provides the "get up and go."***



*The lower wing has been removed, and the battery has not yet been installed. The RX and RX battery have been placed where the servos would normally be. The ESC has been attached to the sidewall with hook-and-loop fastener. The strap is for retaining the aft side of the 16-cell battery pack.*



*Install the battery pack in the fuel-tank bay and lower wing bay. It must go as far forward as possible to get the model to balance correctly.*



*I cut air-cooling exit holes into the lower covering in the aft fuselage. The RX antenna also exits there. The elevator and rudder servos can be installed with one on each side of the aft fuselage; this will save weight and is possible because there is no fuel residue to damage them.*

lage between the stringers, just under the horizontal tail. It doesn't do much good to put those big holes in the firewall to let the air in if you're not going to let it out! All that was left to do was set the control throws to the recommended values and go fly.

## CONCLUSIONS

This ARF model makes a great glow-to-electric conversion. The overall light weight of the structure and the large wing area are major contributors to this fact. The radial cowl allows the use of many motors and speed-reducing systems without the holes that are usually necessary for a glow engine's cylinder head and muffler. Even with the changes to the fuselage that allow it to accept the drive system and batteries, the model still assembles quickly and retains its ARF nature, since you're able to use so many parts right out of the box. A real hot-dog pilot might want to go with 18 or even 20 cells and install a smaller prop to prevent the current from becoming excessive, but the model flies very comfortably on 16 cells. The Stearman is a docile yet aerobatic model—probably just like the full-scale aircraft!

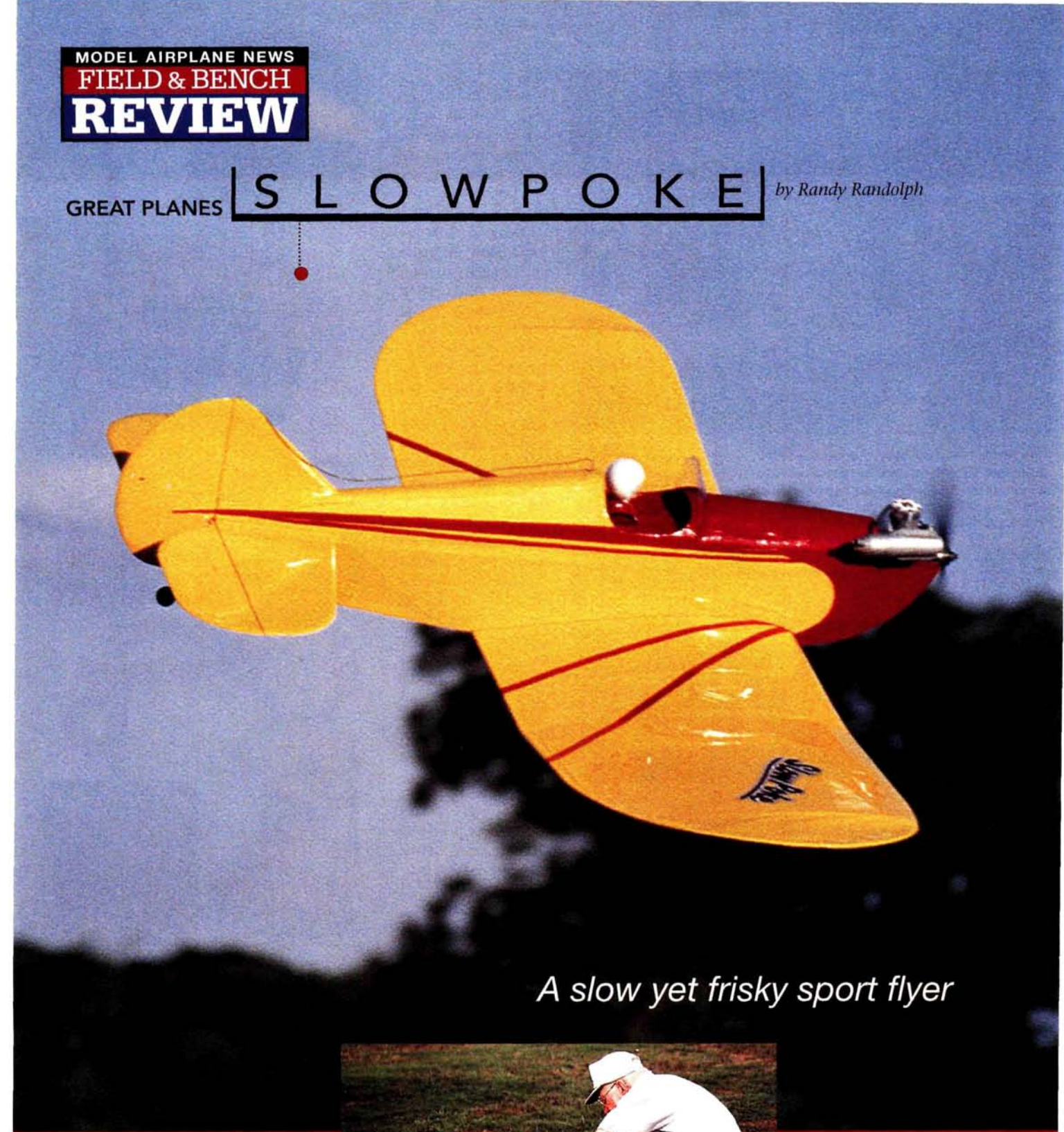
If you have any questions about this or any other electric-model project, email me at man@airage.com.

**Addresses are listed alphabetically in the Index of Manufacturers on page 142.* ✦

MODEL AIRPLANE NEWS
FIELD & BENCH
# REVIEW

## GREAT PLANES SLOWPOKE

*by Randy Randolph*



*A slow yet frisky sport flyer*

There is no question that the indoor RC movement with its nearly weightless airplanes and tiny radios has attracted a lot of attention—so much that a second generation of lightweight, slow-flying airplanes has been developed for those of us who don't have access to indoor flying facilities. Called park flyers, they're capable of indoor as well as calm-weather outdoor flight.

It follows that other airplanes would be developed along these lines. Such craft can handle the wind on an average day at the flying field yet provide the same slow, yet frisky, type of performance achieved by indoor and slow flyers. Enter the Great Planes* SlowPoke!

This model has what it takes to become popular with giant-scale fliers as well as members of Small Model Airplane Lovers' League (SMALL). It neatly bridges the gap between park flyers and typical sport airplanes. It will fly slowly and still behave well in a moderate breeze. I think this airplane will find a home at just about any flying field!

## CONSTRUCTION

From the artwork on the package to the kit's stripwood, hardware and die-cut parts, this airplane just begs to be built! The manual is well-illustrated and offers step-by-step instruction from the first glue joint to the finishing touches—including what to expect when you're flying the plane.

All strips, sheets and die-cut parts are bundled with the hardware according to the subassembly for which they are intended. By any standards, this is a good kit.

• **Tail feathers.** According to the instruction manual, you should build the tail group first. The stab is on the left side of the plan and the elevator is on the bottom right. Because of the size of the plan, the manual suggests that you detach the stab plan so you'll be able to work on it while you're assembling other parts. I don't like to cut up plans, so I built the stab first and then removed it so I could assemble the elevators and fin/rudder on the building board. It took a little extra time, but it kept the plan in one piece.

## SPECIFICATIONS

**Manufacturer**: Great Planes

**Model name**: SlowPoke

**Model type**: slow flyer

**Length**: 36 in.

**Wingspan**: 50 in.

**Wing area**: 656 sq. in.

**Weight**: 3 lb., 7 oz.

**Wing loading**: 12 oz./sq. ft.

**Engine req'd**: .10 to .25 2-stroke or .26 4-stroke

**Engine used**: O.S.* .20 FP

**Prop**: 8x4 (not included)

**Radio req'd**: 4-channel with 3 servos

**Retail price**: $89.99

**Features**: CAD-engineered, all-wood parts; large radio compartment; compact size; easy to fly.

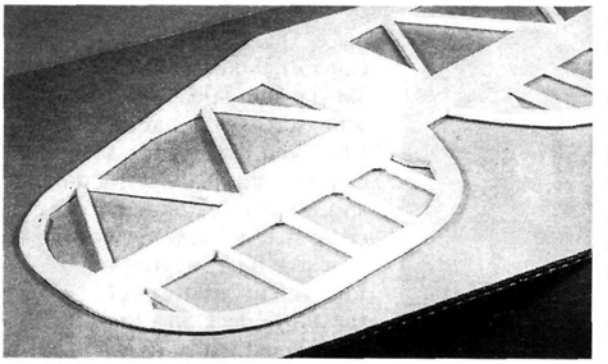
**Comments**: with the SlowPoke, you can have the best of both worlds; it flies slowly, but it's meant for outdoor flight, even in a light breeze. Easy to build and easy to fly, this unique-looking plane will get you into the air with minimal work and expense.

**Hits**

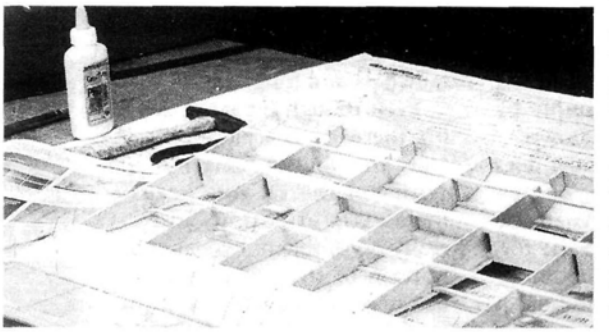
- Comes with everything needed except covering and wheels.
- Good-quality wood and die cutting.
- Very good plans with "personality."
- Well-illustrated manual.
- Reduced-size plan in center of manual.

**Misses**

- Compared with the rest of the wing, wingtips are rather weak.
- The manual has a few gray areas and omissions.



***The tail surfaces are built up, and the control surfaces are very generous. I worried about several butt joints in the elevator and the rudder, but with careful gluing, they proved to be no problem.***



***The wing center and tips are built right over the plan; when all of the top sheeting and capstrips are in place, the wing is turned upside-down, and the LE and TE sheeting is added.***

I did cheat in the tail area. The provided wood was rather heavy, and the tail is not a good place for extra weight, so I substituted lighter wood. By and large, the kit's wood fit the job, but in this case, it missed the mark. Other than that, I built the tail by the book.

• **Wing.** The wing is wide: its center section just about fills up my 20x24-inch building board! Before starting on the wing, I separated all of the wing parts from the die-cut sheets and sanded a few edges here and there. Because I followed the manual step by step, the center section "grew" as smoothly as one could want. Everything fit perfectly.

Instead of using the traditional dowel-through-the-leading-edge (LE) approach to the front wing/fuselage anchor system, the SlowPoke has a nice, square, plywood-encased appendage that fits into the center rib just above—yet is part of—the LE (a very slick system worth remembering!).

After you've completed the spars, ribs, capstrips and top sheeting, you lift the center section from the building board. Then you add the bottom sheeting, capstrips and landing-gear mounts. I advise you to drill the gear mounts before you install them. At this point in the construction sequence, the wing uses a sub-LE and you add the actual LE when you've completed the wing and it has both outboard panels joined to the center section.

Begin the outboard panels by laying down the trailing edge (TE), capstrips and sheeting and then adding the spars, ribs, top sheeting and TE. A plywood gauge that comes with the kit helps you set the dihedral rib at the proper angle.

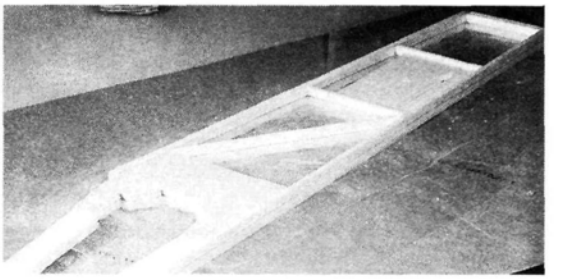
To ensure that the bottom remains flat, complete the panel while it is still pinned to the building board because you add the top sheeting over the ribs that taper toward the tip. When the panels are complete, the tips are added. I was a little disappointed with the way the tips had been cut, and they seemed flimsy compared with the rest of the wing.

The outboard panels are butt-joined to the center section with the help of two ⅛-inch dowels that help with the panels' alignment. I would have liked a joiner of some sort, but this method seemed satisfactory. After you've joined the panels and the glue has set, add the LE, and the wing is then complete and ready for sanding.

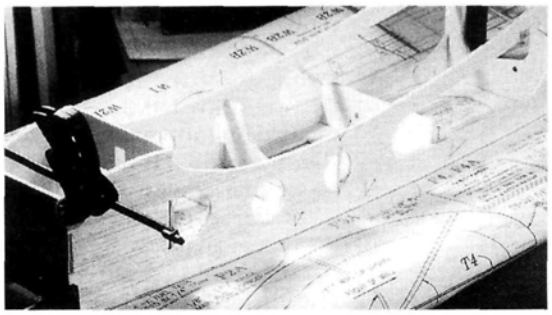
• **Fuselage.** To build the fuselage, you add two plywood doublers to the two partly built fuselage sides and build up the rest of the sides with balsa strips. Build the first side directly over the plan and the second over the first. This practice is very familiar to old-time modelers, and it works very well to ensure that both sides are the same.

When the sides have been completed, they're joined at the tail, and the bulkheads are attached from the tail up to the firewall while the sides are pinned over the top view. When the bottom part of the fuselage is complete, add the top bulkheads from the tail post forward. Install the servo mount between the cockpit formers, then attach the engine mount to the firewall.

If you build the engine mount as shown in the manual, you'll have left thrust



***After the two fuselage sides have been built over the plan, plywood doublers are added to the insides to reinforce the wing and servo mounts. This is the ideal time to drill and finish the pushrod exits to the rudder and elevator.***



***The fuselage sides are pinned over the top view of the plans and then joined with bulkheads and formers. Done this way, a straight and true fuselage is almost guaranteed.***

instead of the intended right thrust. With all later kits, Great Planes includes an addendum to the instructions that corrects this. I noticed the problem during construction, so I corrected it simply by turning the engine mount upside-down!

Although the instruction manual does not tell you to do it at this stage of construction, it is much easier to install the 4-ounce fuel tank before you add the forward sheeting. There is plenty of room for it, but it takes a few extra pieces to hold it in place.

At this point, you'll start sanding, and there's quite a bit to do. Although it isn't shown on the plan, adding fill around the fuselage/stab joints when they have been glued into place will make the covering job easier.

When the fuselage is complete, place the wing in the saddle, and drill holes to match the mounting bolts. After you've cemented the T-nuts below the plywood wing mount, the fuselage is ready to cover.

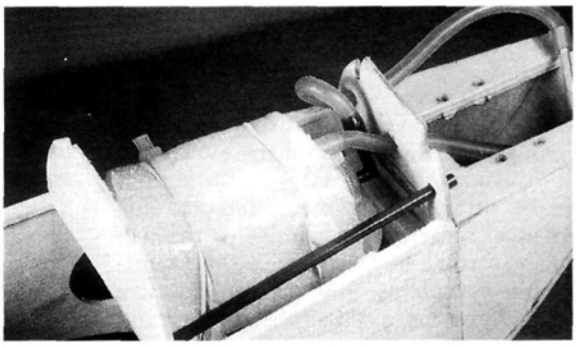
### FINISHING TOUCHES

With the fin and stab already glued into place, the fuselage is a little difficult to handle. It is fairly large by SMALL standards, and a stand of some sort is very handy to hold it while you iron on the MonoKote. Covering this plane is not difficult, and it's even easier—and the covering is less likely to wrinkle—if you use narrow strips for the curved areas of the turtle deck and the "stringered" area aft of the cockpit. Cover the fin, stab, elevator and rudder first, so you'll easily be able to fair the fuselage covering smoothly into them. When you've finished covering the fuselage, add the tailwheel and hinged surfaces.

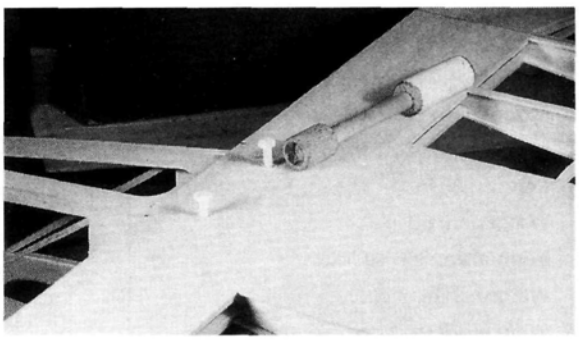
Even though it's large, covering the wing is a piece of cake. Only the built-in hanger at the center of the LE area needs a little extra attention, and it's really no problem. I covered the bottom of the wing first, and before shrinking the film, I covered the tops of the wingtips. These tips are rather weak, and I was afraid the shrinking film would warp them and wrinkle, but by shrinking both sides of the tips at the same time, you can head the problem off at the pass!

Before installing the engine, I painted all of the exposed wood around the engine mount, firewall, landing-gear mount and cockpit with alcohol-thinned epoxy to seal them against exhaust residue.

The kit provides all of the hardware needed to connect the radio system. Since the space in the supplied servo mounts was larger than any servo I owned, I installed smaller mounts to fit my servos. Everything else went smoothly, since the guide tubes had been added during earlier construction.



***Although not mentioned in the instructions, it is much easier to mount the fuel tank before the top turtle-deck sheeting has been added. That way, it is also easier to route the throttle line around the tank.***



***The wing is mounted on the fuselage with nylon bolts. The slip-proof screwdriver shown is simply a hollowed-out dowel with a handle attached and a piece of music wire glued across the opening.***

As long as I can remember, I have hated installing windshields, and this one is no exception. This time, however, it was easier than I expected because I used Balsa USA* Super-Gold gap-filling, odorless glue with their Quick Shot accelerator. Worked like a charm!

### CONCLUSION

The SlowPoke is not the quickest airplane to build, but it isn't difficult and the instructions are good. All of the parts fit, and the hardware package was complete. I wouldn't recommend an engine smaller than a .20 for it because less power would probably mean marginal performance with a plane of this size.

Although you can't expect highly aerobatic performance from the SlowPoke, it has a unique look that's interesting, and it's easy to fly.

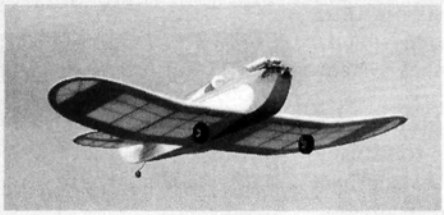
**Addresses are listed alphabetically in the Index of Manufacturers on page 142.* ✚

## FLIGHT PERFORMANCE

**• TAKEOFF AND LANDING**

The SlowPoke's first flight was somewhat less than satisfying. I seemed to have built too much of a warp into the wing, and that caused the airplane to make a steep left turn as soon as it broke ground. Full right rudder made the turn a bit wider, and I executed a wing-low landing without damaging anything except some weeds. A session with the heat gun got the wing back into shape. Trimming started with the next flight and resulted in an airplane that flies as it was designed to.

When you are ready, it will smoothly touch down in a 3-point landing. The steerable tailwheel makes taxiing and takeoff very controllable.



**• GENERAL FLYING**

The SlowPoke flies like a trainer with an attitude! The tail wags a bit before banking, and the response, even with 2 inches of rudder travel, is not rapid. That 2-inch rudder travel is in both directions—a 4-inch total from one side to the other!

**• AEROBATICS**

With the balance point shown on the plans, the airplane will, with a lot of urging, do a slow snap roll and manage a respectable loop, but that concludes the list of available stunts. It will fly slowly with full control, and when the stall does come, it will wallow around and let you know it's coming.

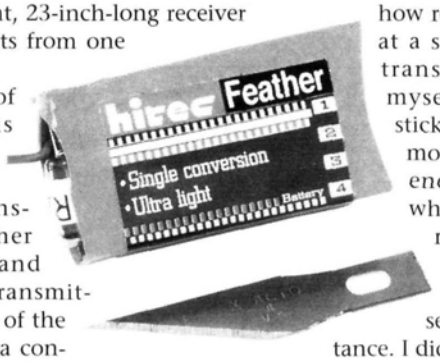
MODEL AIRPLANE NEWS
PRODUCT
REVIEW

# Hitec RCD Feather

## *A high-quality, lightweight micro receiver*

*by Bob Aberle*

The past year's rumors concerning a new, smaller Hitec RCD* receiver have at last come true: the Feather Micro is a 4-channel, FM, single-conversion receiver weighing 7 grams (on my scale)—only ¼ ounce! It is 1⅜ inches long (the crystal projects another 1/16 inch), ¾ inch wide and ⅜ inch thick. A light, 23-inch-long receiver antenna wire exits from one end of the case.




One version of the Feather is compatible with Hitec and Futaba FM transmitters; the other works with JR and Airtronics FM transmitters. On one end of the Feather, there is a connector block that will accept Hitec connectors as well as other brands, but you should be careful about the polarity (it's marked on a label on the side of the heat-shrink tubing case—good idea!). The channel functions are also noted on the case. For use with electric power, an ESC with a BEC circuit is plugged into the throttle port of the receiver. If you require four channels for a glow-powered model, you'll need a Y-cable to connect all four servos and a battery pack.

How well did this new receiver perform? Well, I first checked it for interference with adjacent channels to assess its selectivity. Using a Hitec Spectra synthesized RF module, I was able to generate signals on channels 17 and 19—just 20kHz away from my channel-18 operating frequency; neither channel had any effect on the Feather's performance.

Next, the most important test of a receiver—the range check. I wanted to see how reliably the Feather would work at a significant distance from the transmitter. To range test it by myself, I attached a long spruce stick to the output arm of a servo mounted on a test board. To the end of this stick, I cemented a white, 3x5-inch index card. The resulting stick plus card resembled a pendulum, and with it, I was able to observe the servo's motion from a great distance. I did, however, later enlist the help of flying buddy and fellow *Model Airplane News* contributor Tom Hunt.


PHOTOS BY WALTER SIDAS

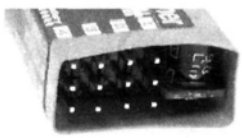
***Compare the sizes of these three Hitec RCD receivers (top to bottom): the dual-conversion Hitec 555 RX, the 2-channel, AM Shredder and the new 4-channel, FM Feather Micro.***

I decided to run my range test with the antenna fully extended because my Flash 5X transmitter antenna doesn't collapse fully. I began to walk away from the receiver while continuously watching the "pendulum." Tom watched the servo up close. At 550 feet from the receiver, I lost sight of the index card, so Tom's eyes took over as I continued to walk away.

After a few more feet, he informed me of some erratic servo operation. The receiver was at ground level, so Tom then raised the test board over his head. The signal was eventually lost at 670 feet, at which point I could make out Tom but could not see the index card at all. An average 30- to 40-inch-span model would not have been visible at this distance.

I did note in my testing that the Feather works best with its antenna fully extended; shortening the antenna reduced its range, but with this kind of range, the Hitec Feather should be quite capable of flying indoor- and parking-lot-type models without any concerns about flying too far away. Its only problem might be with sailplanes, whose altitudes might push the range limits. The selectivity test also indicated that the Feather may be flown at regular flying fields along with other narrowband radio systems, but you should check this out at each field before you fly.

As of June 23, 1999, it is unlawful to sell an RC receiver that has not been tested and certified to meet certain FCC standards regarding the emission of RF "radiation," which can interfere with other electronic equipment. Hitec had these tests done and submitted the necessary details to the FCC. The Feather complies with FCC regulations; if you buy a receiver that doesn't have a decal indicating that it meets FCC test requirements, check with its manufacturer before using it.



***The connector polarity is shown on the side of the case (not visible in this photo).***

Combine the new Hitec Feather Micro receiver with a couple of HS-50 Feather sub-microservos, and you'll have an RC system that's capable of flying a model with a total weight of only a few ounces. I believe that the initial offering price of this receiver will make it particularly attractive to RC "micro" fliers.

I hope that this Hitec Feather Micro receiver, along with the HS-50 Feather servos or even the new, slightly higher output Feather HS-55 servo, will be packaged and sold with both Hitec RCD Flash and Focus transmitters in the near future.

**Addresses are listed alphabetically in the Index of Manufacturers on page 142.* ✦

## SPECIFICATIONS

**Part nos.**: 20272 (Futaba/Hitec); 20372 (Airtronics/JR)

**Weight**: ¼ oz. (7g)

**Dimensions**: 1⅜x¾x⅜ in.

**No. of channels**: 4

**Frequency band**: 72MHz

**Modulation**: FM

**Conversion type**: single conversion

**Street price**: $60 (without crystal)

**Comments**: this narrowband frequency receiver has a good range and is small and light enough to be used in any application, including park and indoor flyers!

**Hits**
- Light and small.
- Narrowband.
- Nice range.
- Compatible with most transmitters.

**Misses**
- For glow engines, you'll need a Y-cable to install the receiver battery.

MODEL AIRPLANE NEWS
HOW TO

# Aerodynamics of Small Glow Models

## *A guide to choosing planes, engines and props*

*by Andy Lennon*

Small, glow-powered RC models are increasingly popular. They are less expensive to buy and to operate, they're easy to transport, and the necessary field equipment is light. You can fly small models at parks, football fields or any open, grass-covered area, and they can be hand-launched, so a runway isn't needed. Because they're lightweight, they tend to hold up better in a crash and they are quieter than larger models.

Recognizing this trend, the RC hobby industry has a vast variety of products from which to choose. This article offers guidance in small model, engine and prop selection to both novice and experienced pilots.

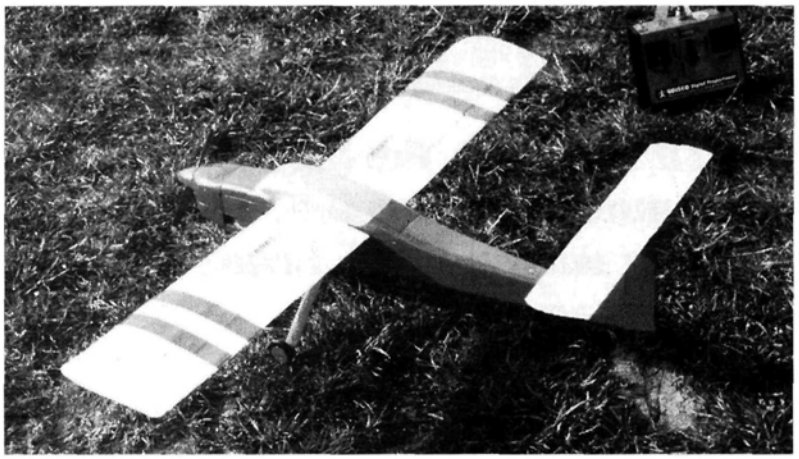
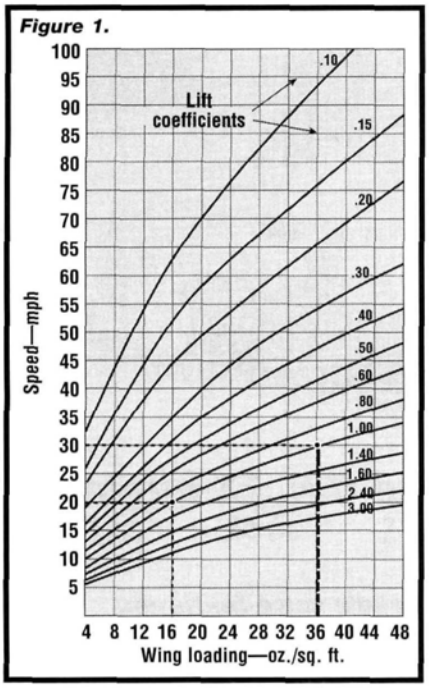
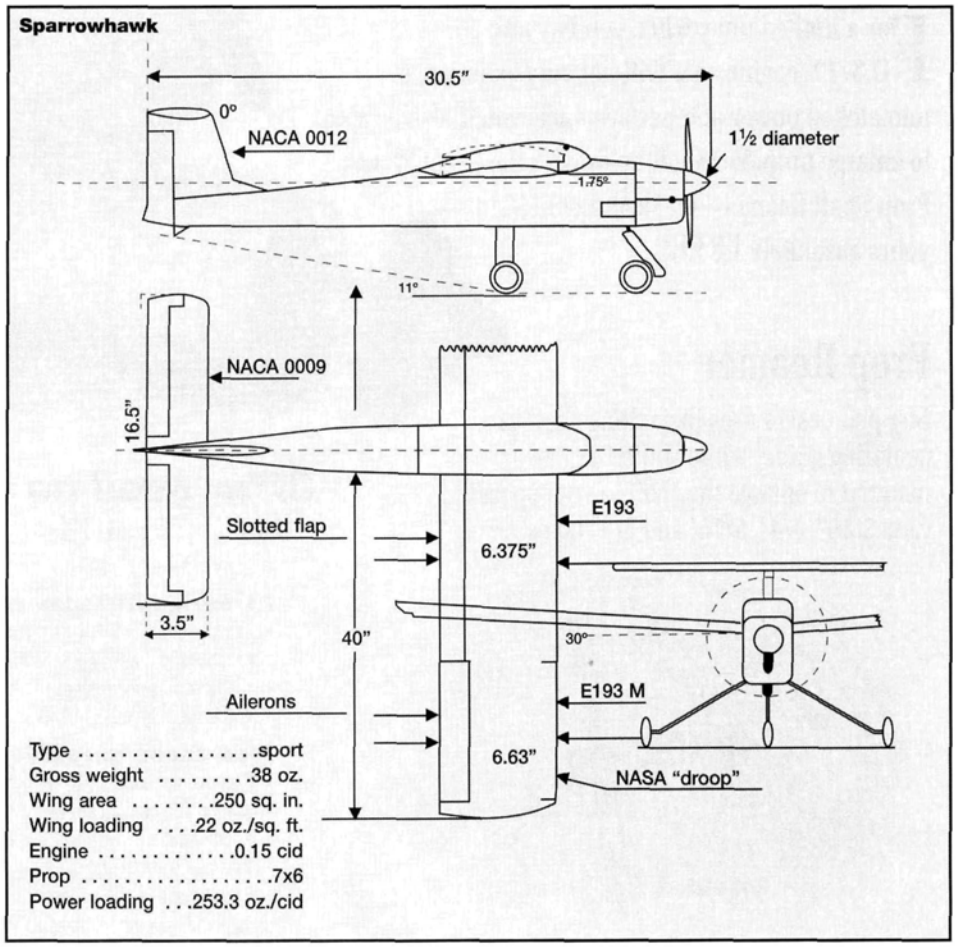


***Figure 1.***




***From wing loading at the bottom, read vertically to the applicable lift coefficient and then move left (horizontally) to find the speed in miles per hour. The stall speed is based on an airfoil's maximum lift coefficient.***



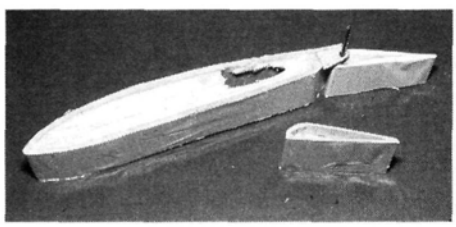

### GUIDELINES

• **Wing loading (W/L).** This is simply the model's weight in ounces divided by its wing area in square feet. It is the first consideration in choosing a model. Its formula is:

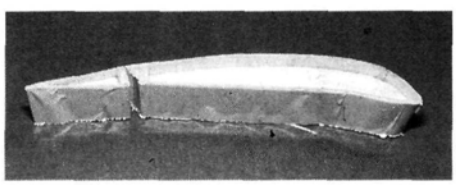
$$\text{W/L (oz. per sq. ft.)} = \frac{\text{model weight in oz. x 144}}{\text{wing area in sq. in.}}$$

Advertisements for model kits give wing area in square inches and weight in ounces. The W/L is easy to calculate from this information. The importance of W/L is that it affects the model's level-flight airspeed. The lower the W/L, the slower that speed.

Figure 1 provides flight speeds (left) at various wing loadings (bottom) and at various wing-lift coefficients (curves).



***Sparrowhawk wing and slotted flap, showing concealed hinging of flap. Wing skins and rib are 1/16-inch-thick balsa; flap skins—1/32; ribs—1/16; plywood flap support—1/16.***



***Sparrowhawk wing: NASA droop and aileron wing skins and ribs are 1/16-inch-thick balsa; aileron skins—1/32; ribs—1/16; spars—3/32 and 3/16 triangular, double MonoKote aileron hinging.***

Most models fly at lift coefficients ($C_L$) ranging from .10 to .20 and will stall close to a $C_L$ of 1.

Using a $C_L$ of .10, a model with a W/L of 10 ounces per square foot flies at 50mph and stalls at 17mph. A comfortable landing speed is 22mph. For a W/L of 20 ounces per square foot, the flight speed is 70mph with the stall at 23mph.

For a beginner, the slower flight speed at low W/Ls is more appropriate, as it allows time to correct the model's flight path. Experienced pilots can handle the higher speed of higher W/Ls, particularly landing speeds.

Wing loading, then, strongly influences model choice.

• **Power loading (P/L).** This is similar to wing loading and is the weight-to-power ratio for 2-stroke engines, assuming an engine of 1-cubic-inch displacement (cid). Its formula is simply:

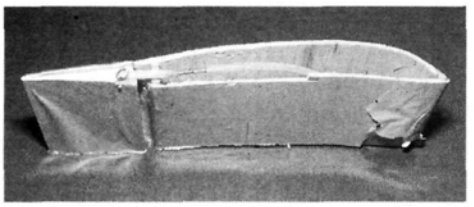
$$P/L = \frac{\text{model weight in ounces}}{\text{engine displacement in cubic inches}}$$

As an example, a 30-ounce model powered by a .10 engine will have a power loading of 30 ÷ .10, or 300 oz. ÷ cid.

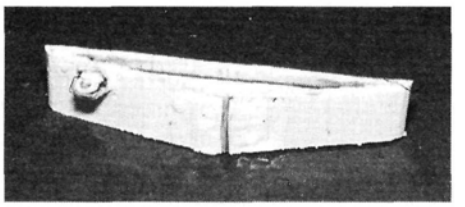
In this author's experience, a P/L of 200 oz. ÷ cid coupled with a good prop selection results in high speeds and out-of-sight vertical climb. Loadings of up to 400 oz. ÷ cid still provide reasonably good performance. The author's Dove, a .15 glow-powered glider, has a P/L of 367 oz. ÷ cid; with an 8x4 prop, it achieves altitude at a surprising rate. Its W/L is 13 ounces per square foot.

Again, the modeler's experience and skill are considerations in choosing an engine size. Larger engine displacements that provide more speed and higher W/L call for more skilled pilots, and vice versa.

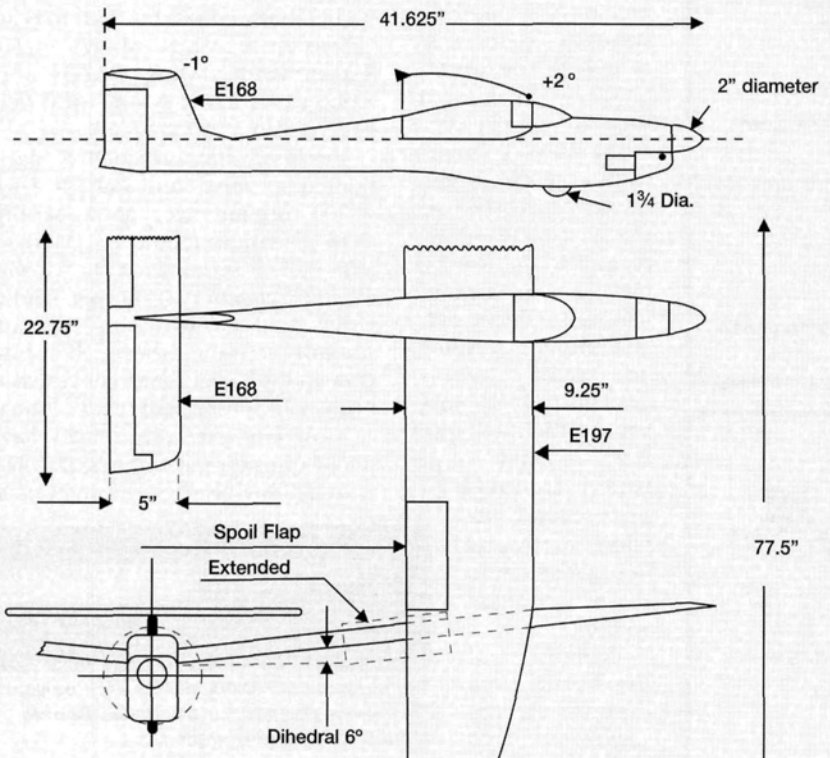
***Concealed linkage to the aileron. Note the wing and flap stressed-skin structures.***



***The Dove's spoil flap—1/16-inch thick balsa; horn rib—1/16 ply.***



**The Dove**




Type .....powered glider
Gross weight .....55.375 oz.
Wing area .....602 sq. in.
Wing loading .....13.16 oz./sq. ft.
Engine .....0.15 cid
Prop .....8x4
Power loading .....367 oz./cid

## ENGINE AND FUEL-TANK SIZE

Small, powerful 2-stroke engines are available with or without throttle control. Without throttle control, the model flies until fuel is exhausted and landing is inevitable. Throttle control permits adjustment of engine rpm at all times, and you can shut it down at your convenience. Landings are at the pilot's discretion, but a throttle servo and appropriate channel on the receiver and transmitter are needed.

A useful rule of thumb for fuel-tank size is 20 fluid ounces of fuel per cubic inch of engine displacement. Tank sizes are:

| Engine cid | Tank size (in fluid ounces) |
|---|---|
| .049/.051 | 1 |
| .061 | 2 |
| .09/.10 | 2 |
| .15 | 3 or 4 |
| .20 | 4 |

Tanks that have a rectangular cross-section similar to the Sullivan* "slant front" are recommended. The flat bottom permits easy installation on two ⅜-inch-wide strips of 1/16- or 3/32-inch-thick plywood running across the fuselage and braced to its sides with ¼-inch triangular balsa. CA small, ¼-inch-thick foam rubber pads to the ply, and CA the tank to the pads. This reduces fuel foaming caused by engine vibrations, yet it leaves the tank visible during filling.

## RADIO EQUIPMENT

Novices should take the long-term view of a radio purchase. If they anticipate that their interest will prove to be more than a passing fancy, they should obtain 4- or 6-channel RC equipment.

Solely to control a model that has only rudder and elevator control, a 4- or 6-channel radio can be used by plugging the rudder servo into the receiver's aileron channel. This provides pitch and yaw control on one stick; the other stick is available for throttle control—or for spoilers, on a glider. As the novice gains confidence and progresses to use the aileron, rudder, elevator, throttle and even flaps, he or she already has the necessary radio equipment.

For models powered by .15 or .20 engines and with wing loadings of less than 15 ounces per square foot, standard servos, a 500mAh battery and a 4- or 6-channel receiver may be used.

The author's Dove has four standard servos, a 500mAh battery and a 6-channel receiver. Powered by a .15 engine and with a W/L of 13 ounces per square foot, it performs very well. For smaller models, with servos weighing fractions of an ounce, small 110mAh onboard batteries and 2- or 3-channel receivers are available.

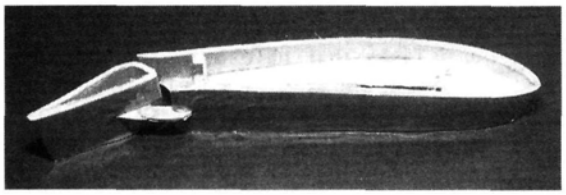
Some desirable RC equipment features are:

- Servo-reversing.
- Trim levers.
- Ni-Cd batteries and chargers.
- Optional dual rates on ailerons and elevators.
- Optional proportional or 3-position, snap-switch-controlled, sixth channel.

The author's Sparrowhawk had five small servos, a 250mAh battery and a 6-channel receiver. Powered by a .15 engine and 7x6 prop and with 250 square inches of wing area, it was fast and very nimble and demanded good piloting. At a W/L of 22 ounces per square foot, it landed at a fast speed with flaps up; it had slotted flaps to slow landings to close to 20mph.

## CONTROL LINKAGES

Most kits and ARFs provide control linkages and map out the location of servos, receivers and battery; those who design their own models or build from plans can choose from a variety of linkages that go between servos and control surfaces.



***Skylark wing with external flap hinging. Wing skins and ribs—1/16-inch-thick balsa; flap skins—1/32; ribs—1/16; spars—1/8-inch square with 1/32-inch-thick webs (vertical grain); flap horn—1/16-inch ply; flap supports (two)—1/32-inch ply.***

This author has had excellent results using Sullivan stranded-steel cables running in plastic tubing. These come in 0.056- and 0.032-inch diameters. The latter size is ideal for small models. These linkages provide direct "no slop" connection, have low friction, can go around corners and are great for T-tail elevator control. Located close to the fuselage's inside walls, they do not interfere with the installation of the receiver or battery; servos in the wing's center section are easily connected via cable to ailerons and flaps.

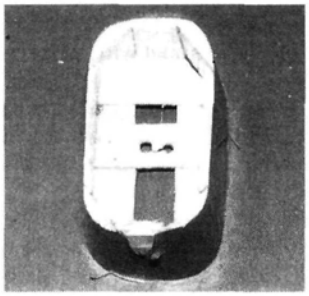
CA the cable into mini Kwick-Links (by Du-Bro*) at the control ends, and use connectors at the servo ends. The setscrews provide for easy neutral adjustment. Small holes in the fuselage bulkheads or wing ribs permit easy installation of the outer tubing.

On small models, the cable may be connected to the control surface with a short piece of the plastic tubing—one end flattened with heat and drilled to take a tiny screw threaded into a plywood end rib. CA the cable into the open end of the tubing.

Before you install the outer plastic tubing, it is easily bent using a heat gun (bend the cable by hand). Secure both ends of the outer tubing to the model's structure with CA. Complete the installation with CA at each rib or bulkhead.

The author's designs feature a removable fuselage top. Held at the front by two dowels and at the rear by one screw, it is easily removed and replaced. The throttle, elevator and rudder servos are positioned just behind the fuel tank; the receiver and battery are under or just behind the wing; aileron and flap servos are in the wing's center section.

Removal of the fuselage top exposes all the servos, the tank and the nose-wheel steering for inspection and adjustment. The tank is filled "top off." This is a great convenience at the flying field.



***Typical fuselage construction: 3/32-inch-thick sides, top and bottom; 3/16 corners, 3/32 bulkhead.***

The author has noted no radio interference on 10 or more models equipped with the Sullivan cables.

## SCALE EFFECT

Scale effect limits performance by reducing wing lift and increasing drag for small models. It is measured by the Reynolds number (Rn), and its formula is "dead easy":

**Rn = speed (mph) x chord (in.) x K**

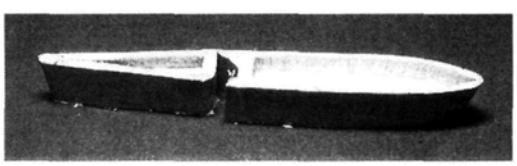
**(K at sea level is 780; at 5,000 feet, it is 690; at 10,000 feet, it is 610.)**

A wing with a 5-inch chord on a plane flying at 40mph at sea level (40x5x780) is at an Rn of 156,000; a tail surface of 3-inch chord at 40mph is an Rn of 93,600.

The airfoil curves shown in Figures 2 and 3 are of wing sections developed for good performance at a low Rn by Dr. Richard Eppler. These reveal that the maximum $C_L$ is little affected by the lower Rn, but drag (on the left) increases substantially at a lower Rn. Also, the symmetrical sections such as E168 (Figure 3) have higher drag and less lift than the cambered airfoils such as E197 shown in Figure 2. Recommended wing airfoils are E193, E195, E197, E205; symmetrical tail airfoil E168 is also recommended.

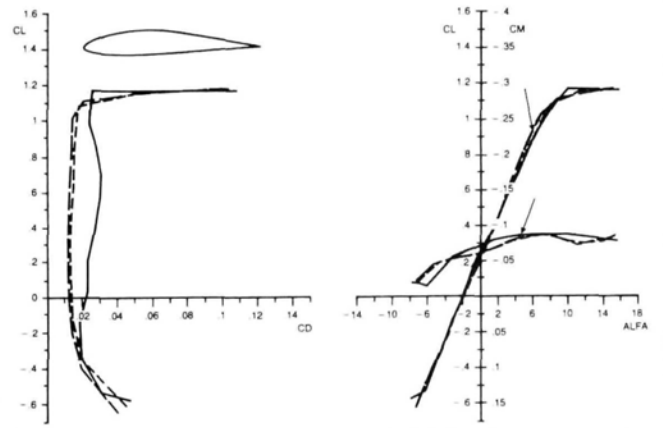
Increased drag on small models is not limited to wings and tails; it affects the whole airplane. For good performance, close attention should be given to drag-reduction (see reference 1). Cowling the engine (reference 2); fairing landing-gear wires, and construction that includes smooth contour wheels, bolt-on-wings, thin trailing edges and concealed control horns will substantially reduce drag.

Most kits and ARF models have high drag from exposed engines, fat tires, bare-wire landing-gear legs, dowel and rubber-band wing attachment, thick trailing edges, sheet-balsa slab tail surfaces and exposed control horns. For a novice pilot, this is not a bad idea. It slows the model, steepens its glide and makes landings slower and easier to judge.



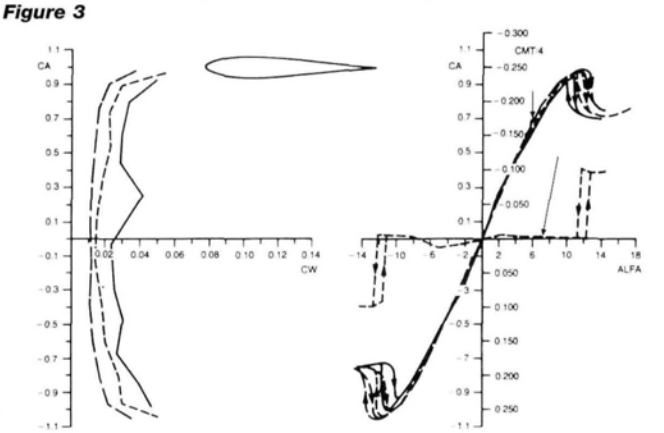
***Tail surfaces. All skins are 1/32-inch balsa; ribs—1/16; spars—3/32 and 3/32 triangular. Double MonoKote elevator hinging.***

***Figure 2***




***Eppler 197 is a moderately cambered airfoil with a soft, gentle stall. It has very low drag.***

***Figure 3***




***Eppler airfoil 168 is symmetrical with no pitching moment, except at the stall, during which the airfoil becomes nose-down and is stabilizing.***

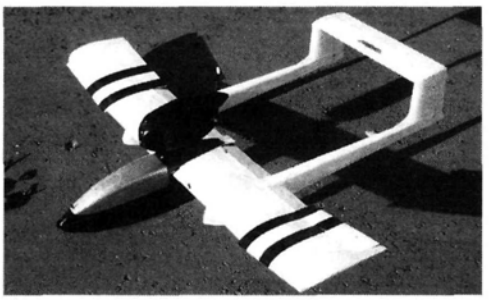
**TABLE 1. PITCH, RPM AND SPEED**

| Prop pitch (in.) | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| Static rpm | Speed in mph | | | | | | | |
| 11,000 | 25 | 38 | 50 | 63 | 75 | 88 | 100 | 113 |
| 12,000 | 27 | 41 | 55 | 68 | 82 | 96 | 110 | 123 |
| 13,000 | 30 | 45 | 60 | 74 | 89 | 104 | 119 | 134 |
| 14,000 | 32 | 48 | 64 | 80 | 96 | 112 | 128 | 144 |
| 15,000 | 34 | 52 | 69 | 86 | 103 | 120 | 137 | 154 |

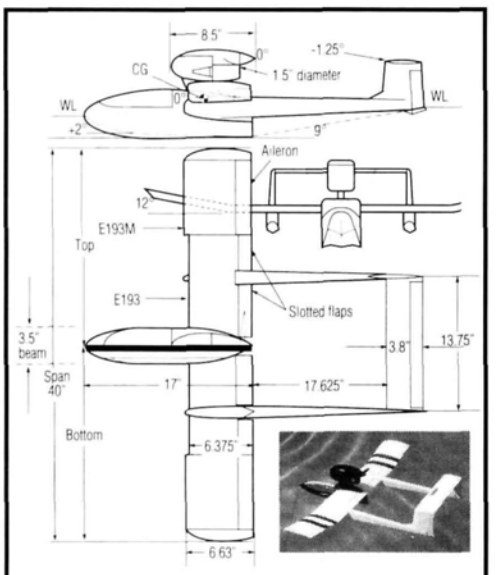
For the expert pilot, however, the high drag absorbs much of the engine's power, leaving less for maneuvers, and it reduces the model's performance. This author has larger, low-drag designs that are powered by .46 engines but perform as though they use .60-size power.

## PROPELLER SELECTION

Because the prop converts the engine's power to thrust, selection of prop diameter and pitch is a critical factor for good performance.



***The Sea Loon flying boat.***




**SEA LOON**

Type .....amphibious flying boat
Gross weight .....40 oz.
Wing area .....250 sq. in.
Wing loading .....23 oz./sq. ft.
Beam2 loading .....3.26 oz./sq. ft.
Engine .....0.15
Prop .....7x4 pusher
Power loading .....266.6 oz./cid

**TABLE 2. ENGINE DISPLACEMENT AND PROPELLER DIAMETERS**

| Engine displacement (cid) | Prop diameter (in.) |
|---|---|
| .049, .051, .061 | 4.5 to 6 |
| .09, .10 | 6 to 8 |
| .15, .20 | 7 to 9 |

The diameter and pitch selected should be matched to the engine's power and to the model's speed. Rpm and pitch control speed; pitch and diameter control rpm. For low pitches, use relatively large diameters; for high pitches, use smaller diameters.

Because wing loading affects speed, the first consideration is the model's speed at a $C_L$ of .10 (Figure 1). The lack of published horsepower and torque-curve data for these small engines is unfortunate. However, it is known that they operate at rpm of between 11,000 and 15,000. A recent advertisement for an .09 engine quoted an excellent 15,000rpm on a 7x4 (7-inch diameter, 4-inch pitch) prop. For our purposes, a mean rpm of 13,000 (see Table 1) will be used. This table provides airspeeds at various pitches and rpm. Table 2 gives suggested diameters for each engine size.

Sparrowhawk will serve as an example: W/L was 22 ounces per square foot, it had a .15 engine, and speed at $C_L$ .10 was 73mph (Figure 1). Table 1 indicates a 5-inch pitch at 1,300rpm. However, because this model had low drag and one objective was high speed, a pitch of 6 inches was chosen.

Referring to Table 2, a .15 engine takes 7-, 8- or 9-inch-diameter props. To allow the engine to "rev up," I used a propeller diameter of 7 inches. Sparrowhawk actually had a 7x6 prop at 12,000 static rpm and a speed of 82mph (Table 1).

Another example is the glow-powered glider Dove. Its W/L is 13 ounces per square foot and speed at $C_L$ .10 is 59mph. Table 1 indicates 4-inch pitch and Table 2 indicates an 8-inch prop diameter. This model is .15-powered and actually uses an 8x4 prop.

Table 1 is based on Dave Gierke's "Real Performance Measurement" reports in *Model Airplane News*. He provided static rpm and airspeeds for a wide variety of engines and propellers.

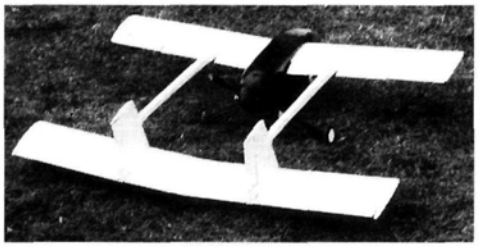
To confirm your choice, use a tachometer to check actual static rpm with the selected prop. APC* props give excellent results. Figure 4 details a tandem-wing model, Wasp, that is powered by a .15 engine.

## STRUCTURE

When you build from a kit or from plans, you are locked into the model's structure; only minor modifications can be made. When you design your own small models, you have freedom of choice. This author recommends stressed-skin structures (reference 3). For lightness and strength, these airplanes have structural material on their outside surfaces as far from the "neutral axis" as possible.

The accompanying photos show construction details of wings, tails, fuselage and flaps for small models. All are stressed-skin designs.

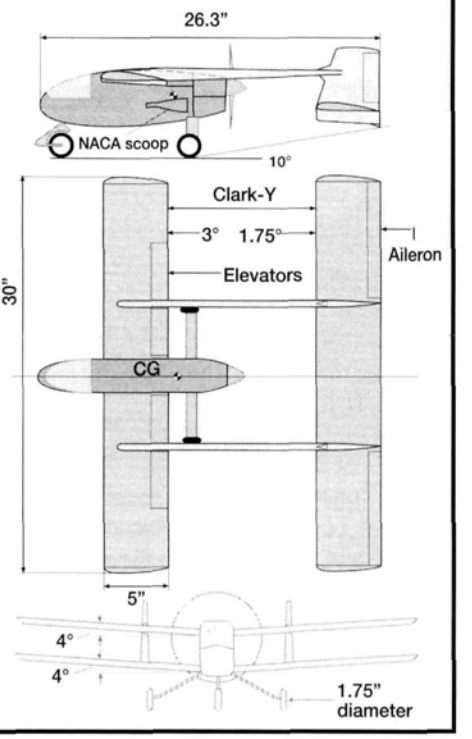
Happy landings!



***The Wasp tandem-wing biplane.***

**WASP**

Type .....Tandem-wing biplane
Gross weight .....36.25 oz.
Wing area .....300 sq. in.
Wing loading .....17.42 oz./sq. ft.
Engine .....0.15 cid
Prop .....7x4
Power loading .....241 oz./cid




**Addresses are listed alphabetically in the Index of Manufacturers on Page 142.*


***Model Airplane News* References**

**1.** "Improve Performance by Reducing Drag," January, February, March 1992.

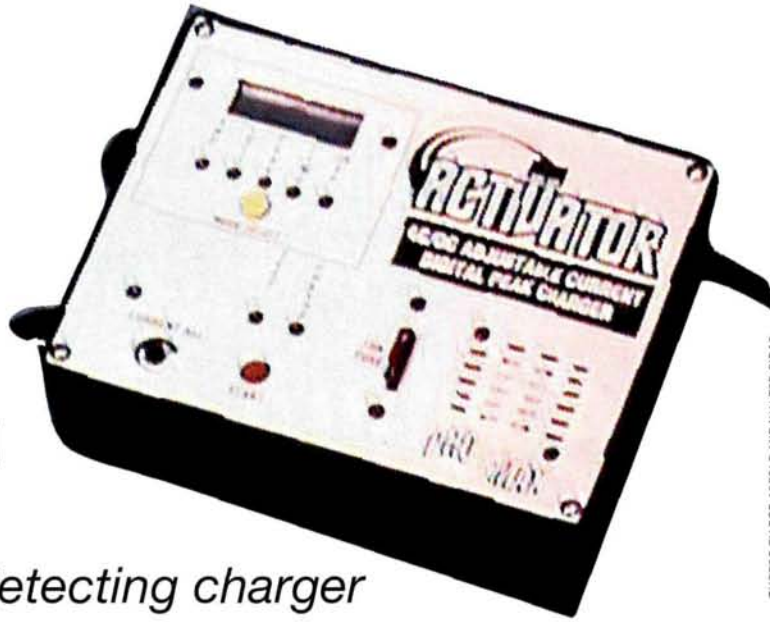
**2.** "Ducted Engine Cowl Design," August, September 1994.

**3.** "Stressed-Skin Design and Weight Estimating," September, October 1992.

These articles and more are contained in the book "Basics of R/C Model Aircraft Design" available from Air Age Inc., publishers of *Model Airplane News*.

MODEL AIRPLANE NEWS
PRODUCT
REVIEW

*by Bob Aberle*



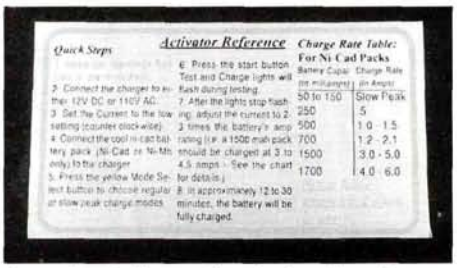

# Global Hobby Distributors ProMax Activator

## *An adjustable-current, peak-detecting charger*

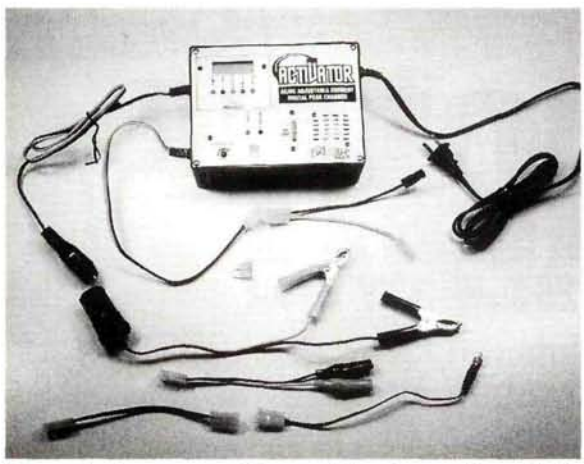
The Global Hobby Distributors* ProMax Activator is an adjustable-current, peak detection-type charger that is capable of charging from one to eight Ni-Cd or NiMH cells with capacities ranging from 50 to 2000mAh. For very small batteries, it can also provide a fixed, slow-rate charge of 200mA and still use the peak-detection feature. Input power can be either 115V AC from a standard outlet or 12V DC from a car battery or other low-voltage DC supply. All the necessary cables are provided including a cigarette lighter-type plug as well as alligator clips. The output cable has standard Tamiya-type connectors, but you can easily make up adapter cables with Sermos* or AstroFlight* Zero Loss connectors. It also comes with a special connector to allow you to charge single-cell, glow-plug lighter batteries.

The ⅝x1⅝-inch LCD screen on the front face of the Activator has generous-size, ½-inch numerals. With a mode select switch, the user can choose various readouts such as charge current, voltage under charge, peak voltage reached while charging, time it took to reach full charge and slow- or low-level peak charge. There is also a green charge indicator LED that glows under charge and a red test LED that lets you know if the battery is ready for charging. Be advised, however, that the "test" function does not provide discharge or cycling-type testing or conditioning.

The instructions are very thorough, easy to understand and brief. As an added feature, a summary of all the operating instructions appears on a label outside the charger case. I like this feature very much and wish that more manufacturers would offer it.




***A neat set of operating instructions is provided on this label, which is affixed to the side of the charger—very helpful!***




***The activator comes with everything from a household, AC plug to DC alligator clips and a cigarette-lighter plug. If you don't like the Tamiya-type connectors, simply substitute one of your choosing or make an adapter.***

### CHARGING

The charging sequence is quite simple. First, connect the Activator to an input power source. Make sure that the current adjustment knob is at the minimum position (completely counterclockwise). Connect a 1- to 8-cell battery to the output connector. Press the start button, and you will see both the charge and test LEDs flash for about 5 to 8 seconds until a special test sequence has been completed, after which the flashing stops. The charge LED then glows steadily, and the test LED is extinguished.

Make sure your screen meter is selected for the "amp" display (use the mode select switch to do this). Now, rotate the current adjustment knob clockwise, and you'll see the charge current change on the screen. The instructions are very helpful in determining the proper charging levels. Basically, you should be using the fast charge rate of three times the battery's rated capacity, although you should limit the fast charging rate to no more than the 2C rate for NiMH batteries. If a Ni-Cd is rated at 1000mAh (1 amp/hr), you would set the charge current at the 3C rate (3

### SPECIFICATIONS

**Model name**: Activator

**Manufacturer**: ProMax

**Distributor**: Global Hobby Distributors

**Type**: adjustable-current, peak-detection battery charger

**Size**: 7x5x2½ in.

**Input**: 115V AC or 12V DC

**Power plugs included**: alligator clips, cigarette-lighter adapter

**Battery plug included**: Tamiya-type

**No. of cells**: one to eight

**Capacity range**: 50 to 2,000mAh

**Current range**: 0.5 to 6A

**Street price**: $100

**Comments**: the ProMax Activator is a neat, reliable peak-detect charger that works great at home or at the field. Whether you need to charge an 8-cell pack or just your glow-plug lighter, the Activator is a good choice!

**Hits**
- Many options and features.
- AC and DC.
- Glow-plug lighter adapter included.
- Easy to use.
- Wide range of abilities.

**Misses**
- No power on/off switch.
- Only charges up to eight cells.

amps). At that rate, a fully depleted battery pack should be fully charged in about 20 minutes. When the peak voltage has been reached, the battery is fully charged; the Activator will beep three times, and the green charge LED will go out. Then, the charger will stop automatically and revert to a fixed-level maintenance charge level of 100mA—trickle charge.

After charging, you can use the mode-select button to scroll around the various readings available on the screen. For example, you can display a battery's peak voltage or the length of time it took to charge. These readings will stay in the charger's memory until the battery has been disconnected.

At the start of the charging sequence, you can also select the fixed-rate charging level of 200mA for small battery packs (from about 50 to about 200mAh). This special lower rate also has a peak detect feature that will automatically terminate the charge. Because it is a fixed rate, however, and because of the peak-detect feature, you cannot use this output choice for C/10, overnight charging; sorry!

### FINAL THOUGHTS

I liked the Activator very much; I hope a second version will be offered to handle 12- to 18-cell batteries. I also want to mention that although the charger is rated at 0.5 to 6A charge current, I couldn't quite get to that level. For example, when charging an 8-cell battery using 115V AC power, the highest level I could reach was 5.8 amps, which is still very acceptable. But, when connected to a new car battery, I could only reach about 4 amps for the same eight cells. For batteries of up to about 1400mAh capacity, this is OK because you can still reach a 3C charge rate. But with 2000mAh cells, it would probably take an additional 15 minutes to get a full charge. Of course, you could start your car and allow the alternator to produce a few more volts to the battery, which would probably raise the charge current level. Again, this is just a minor consideration.

As a side note, I would like to see a power on/off switch on this charger. Without such a switch, every time you connect to your car battery, you get a spark. You can add an in-line switch to the power input cable to stop this.

ProMax should be congratulated for developing and marketing such a neat, reliable peak-detect battery charger. This charger would also be an excellent choice for fast-charging your batteries in the field, as long as you stayed within the manufacturer's guidelines.

**Addresses are listed alphabetically in the Index of Manufacturers on page 142.* ✚

*by Peter H. Riddle*

# The Northlander

## SPECIFICATIONS

**Model:** Northlander

**Type:** sport

**Length:** 39 in.

**Wingspan:** 56 in.

**Wing area:** 627 sq. in.

**Weight:** 92 oz.

**Wing loading:** 21.13 oz./sq. ft.

**Airfoil type:** symmetrical

**Power rec'd:** .40 to .46 2-stroke

**No. of channels req'd:** 4 (aileron, rudder, throttle, elevator)

**Comments:** designed by Peter Riddle, the rugged Northlander is a good all-around sport model for a .40 to .46 engine. Made of balsa, plywood and lite-ply, its box fuselage and constant-chord wing make it relatively easy to build.

## *A rugged, .40-size sport flyer*

The 4-channel Northlander is predictable and stable. Any good .40 will fly it, and its symmetrical shoulder wing makes it semi-aerobatic. For more aggressive performance, build it with a flat wing and power it with a Tower Hobbies* .46. The box-type fuselage is given a more rounded look by the additional external stringers.

Building is straightforward, and the materials used are readily available; the cowl is available from Fiberglass Specialties*, and the 10-inch-long canopy is from Sig*.

## CONSTRUCTION

• **Wing**. Start by cutting out all the ribs; you'll need four W1, 14 W2 and four W3 ribs. Two of the W1 ribs are of 3/16-inch balsa and two are 3/32-inch balsa.

Stack them and sand them to a uniform shape. With the ribs still stacked, drill two 1/8-inch holes through them, holding the stack in a drill press. To hold the ribs in alignment while you sand them to final shape, insert an 1/8-inch music-wire rod through each of the holes you drilled.

Score the ribs lightly where the dihedral braces will be installed (shown on the plan), but don't cut completely through them at this point. Mark the top of the ribs to ensure that you do not install them upside-down.

On a flat building board, first assemble the left wing panel. Cover the plan with wax paper, and lay out the 1/4-inch-spruce lower main spar. Make a full-length, 5/16-inch-high shim, put it where the rear spar will go, then cover it with wax paper. Pin the lower 3/16-inch-balsa rear spar over the shim and into the building board. Working from their tips, glue the ribs to the spars with CA. Make sure they line up evenly with the bottom of the spars. Finally, install the 3/16-inch-thick W1 rib at the root end, using the dihedral gauge to achieve the correct angle.

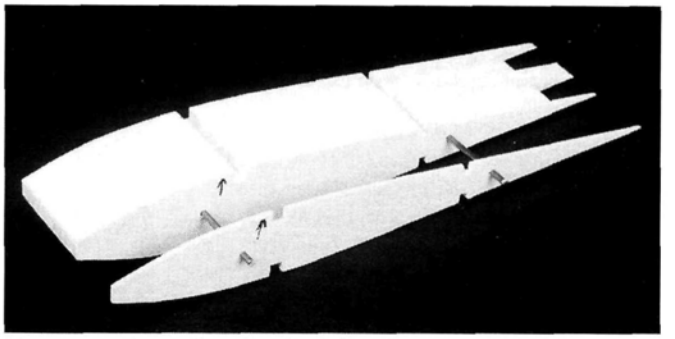
Install the upper spars, and then recheck to ensure that everything is still square. The spars should fit fully into the rib notches and be even with the rib tops. Check for warps, then CA the spars into place.

Sand the 1/4-inch-square, hard-balsa aileron-mount strip to taper it slightly toward the rear, then glue it into place. Fasten the LE to all the ribs, allowing a 1/16-inch overlap, top and bottom, so the LE sheeting can be butted against it. I used a preshaped LE, but you could also use ordinary 1/2x3/8-inch balsa after you've added the sheeting.

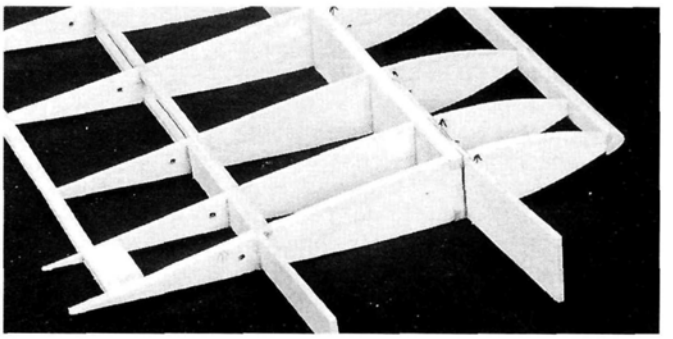
Along the main spar's rear edge, glue 1/16-inch vertical-grain-balsa shear webs between all the ribs. Cut through the W1 ribs where you scored them, and install the large dihedral brace along the front edges of the main spars. Test-fit the brace to ensure its centerline is flush with the root rib's outer surface. Trim it if necessary, then epoxy it into place. Repeat this process for the smaller dihedral brace along the rear edges of the rear spars.

Make the aileron torque-rod mounting block out of 3/8x3/4-inch hard balsa, and slot its back edge to receive the torque-rod hinge assembly. Glue the block into position, as shown on the plan. Sand it to the shape of the ribs, then sheet the wing's upper surface. When you're satisfied that the wing panel is absolutely straight, lay out the lower rear sheeting on the plan, and pin it securely to the building board. Remove the shim that's under the rear spar, and pin the aileron mounting strip down onto the sheeting. Securely glue the TE and all the ribs to the lower sheeting. Do not cut out the aileron area yet.

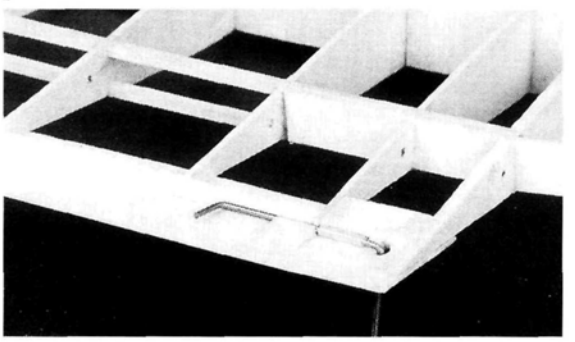
Remove the wing from the plan and install the aileron control-rod hinge in the slot that's in the mounting block between the W1 ribs. I used a Du-Bro* no. 101 aileron-torque-rod assembly. Cut a hole in the sheeting to allow the rod to pass through, then, to provide clearance for the rod, cut the 3/32-inch W1 rib just aft of the aileron mounting strip. Fasten the rod hinge with epoxy, taking care to avoid gluing the rod to the hinge collar. Note that the end of the rod that's attached to the servo points downward.



***To ensure wing uniformity, stack the ribs accurately and sand them as a unit. Take special care to line up the spar notches, and don't sand them out too much. They should fit the spars tightly. Mark each rib's top with an arrow to identify it.***



***Install the dihedral braces before you sheet the left wing panel. The LE and aileron mounting strip are butt-glued to the ribs. Notice the aileron rod mounting block between the two end (W1) ribs at the TE.***



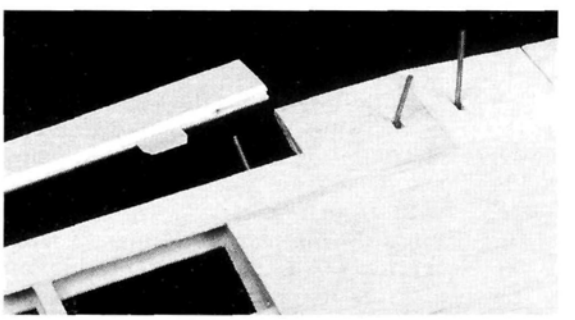
***The hinge on the aileron control rod fits into a slot in the spacer block and is held in place by a little epoxy. Balsa filler blocks help strengthen the wing in this area.***

From 3/16-inch balsa sheet, cut a filler block to fit between the W1 ribs aft of the aileron control rod, then glue it into place. Cut another filler block from 1/2-inch balsa and glue it to the rear outer side of the 3/32-inch W1 rib. This spacer provides the proper clearance between the aileron and the fuselage. Carefully sand all of the filler blocks to the shape of the ribs, then cut away the sheeting from the aileron bay.

Complete the wing sheeting, being sure to allow the aileron control rod to protrude through it. Glue the top and bottom cap-strips to all the ribs. Sand the ends of the root ribs and tip ribs flat, then cut a wingtip from 1/4-inch soft balsa and glue it into place. It's easiest to cut the tip oversize and then sand it to shape after it has been glued into place.

Cut the 1 1/4x5/8-inch aileron stock to fit, leaving a 1/16-inch space on both ends. Measure along the aileron LE to ascertain the correct position for the control rod, and then drill a hole for it. Cut a channel from the hole to the end of the aileron to take the control rod. Add the hinges to the aileron and test-fit to the wing, but do not glue it yet. Taper the TE to match the aileron's profile.

The right wing panel is built upside-down on the plan. When the right panel has been fully sheeted and the aileron has been test-fitted, cut the slot in root rib W1 for the dihedral braces, and join the two wing halves. Trim and sand them as necessary until



***Be sure the strip aileron moves freely when it's mounted on its hinges and the control rod.***

## FLIGHT PERFORMANCE

**• TAKEOFF AND LANDING**

I entrusted Northlander to fellow club member Barry Lloyd, who has much more air time experience than I do. The first takeoff was quick and uneventful. With the powerful ball-bearing .46, Northlander literally leapt into the air. Once aloft, it needed only a click or two of trim, and it soon proved itself stable and predictable.

Six of the seven test flights were made with the flat wing, which would be more than stable enough for all but the least experienced pilot. I recommend this version, unless you want the extra security of dihedral. In Barry Lloyd's capable hands, landings were picture-perfect. Thanks to its generous wing area, Northlander comes in slow and steady—gentle three-pointers that are completely free of any bouncing.

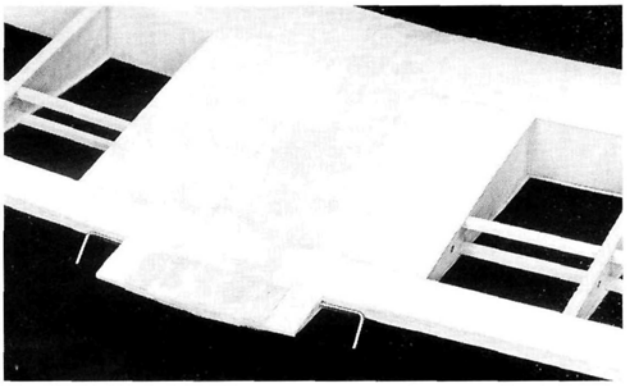
**• AEROBATICS**

Barry tried a few basic maneuvers—rolls, loops, a couple of hammerheads and inverted flight—all of which were easily accomplished. I then took over the stick and found the plane stable and forgiving. Nothing about its performance threatened my fledgling's confidence.

If you'd like to fly a predictable sport model that takes moderate aerobatics in its stride, try a Northlander. Its unusual profile and strong performance should attract favorable attention wherever you fly it, and its sturdy construction promises a long life.

they fit tightly together, then check that the dihedral gives 1½ inches under each tip. Trim or sand the dihedral braces as necessary to achieve this dihedral measurement, making sure that the braces do not warp the right panel, then epoxy the panels together. When the epoxy has set, wrap the wing joint with lightweight fiberglass cloth, and glue it into place with thin CA.

Cut two wing-bolt reinforcement plates out of 1/32-inch ply, and epoxy them to the wing-bolt areas on the upper and lower wing surfaces. Cut the lower plate to clear the aileron control rods, then cut away the lower wing sheeting just aft of the main spar and install the aileron servo rails. Sand all the surfaces smooth. This completes the wing, except for the installation of the mounting dowel.



*Fiberglass cloth and 1/32-inch-ply wing-bolt reinforcement plates ensure a strong wing joint.*

• **Fuselage**. The sturdy box fuselage has lite-ply sides and built-up formers. Start by making all the formers (F2 through F7) from 3/16-inch hard balsa, and reinforce them all at each former's corners with 1/32-inch-ply gussets. Also cut out the 1/4-inch-ply firewall, the 3/16-inch-ply wing-bolt plate and the 1/8-inch ply wing plate. Add the 3/32-inch formers F5A and F6A to the tops of formers F5 and F6.

Cut out the two lite-ply sides. To ensure uniformity, cut one out first and use it as a template to cut the second. Tack-glue them together, and sand all the edges so both sides are the same, then taper the wing-saddle area to fit evenly against the wing.

On the inside surfaces of both sides, mark the locations of the formers. Using a square, glue formers F2, F3 and F4 to one side, then glue the other side to the formers. Pin the fuselage to the top view on the plan and pull the sides together at the rear. Taper the balsa tail post to the shape shown in the top view, and glue the fuse sides to it. Now install formers F5, F6 and F7. Bevel the formers' sides slightly so that they fit flush against the fuselage sides. Make sure the fuselage remains straight.

Cut the two landing-gear mounting blocks to length and install them between the fuselage sides. The rear block lies flush against former F3, and you must position the front block to accommodate your choice of landing gear (I used the 16-inch gear available from Hobby Lobby Intl.*—part no. RA1094). Add 3/8-inch triangle-stock reinforcements in the indicated positions, then epoxy mounting blocks into place and sheet the fuselage bottom with cross-grain 3/32-inch balsa, from former F2 to former F4.

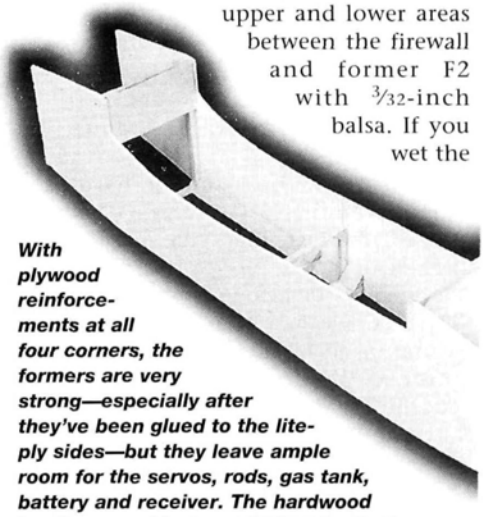
Place the wing in the saddle and test fit the wing-bolt plate. Leaving enough clearance for the dihedral joint, epoxy the plate into place and reinforce it with 3/8-inch triangle stock. Epoxy the forward wing plate to former F2. Place the wing in the saddle, centering and aligning it carefully with the fuselage sides. When the wing is level and aligned, drill and tap the wing-bolt holes and install the 1/4-inch nylon wing bolts.

Working from its front, drill through the F2 wing plate and into the wing for the 1/4-inch hold-down dowel. Remove the wing, cut a length of dowel, round its end, and epoxy it into the wing. Test-fit the wing in the saddle again, and sand the dowel as necessary until it fits the hole snugly.

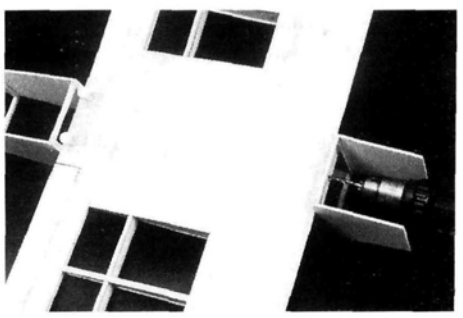
Drill the firewall to fit your engine mount and steering gear. Note that the thrust line is centered exactly on the firewall, and the engine is side-mounted to the right. Epoxy the firewall between the sides, and install 1/2-inch triangle-stock reinforcements as shown in the top view.

I installed the nose-gear assembly behind the firewall, but if you use a conventional engine mount, you'll be able to install the nose gear on the front of the firewall for easier access.

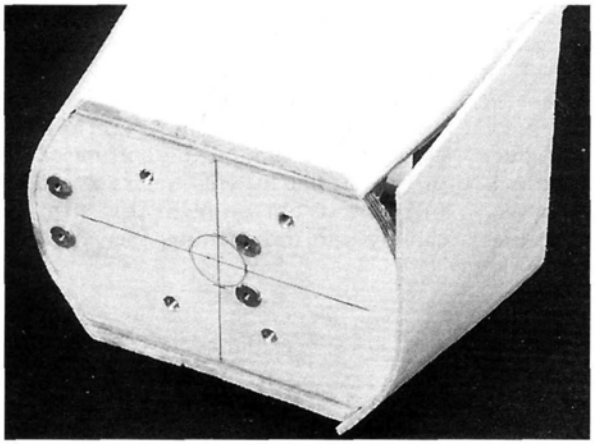
Cut out two, 3/16-inch-balsa wing-saddle doublers, the lower forward doubler and the filler piece that fits aft of former F4, and glue them all into place. Install the 3/16-inch-square balsa stringers along both sides, and sheet the upper and lower areas between the firewall and former F2 with 3/32-inch balsa. If you wet the



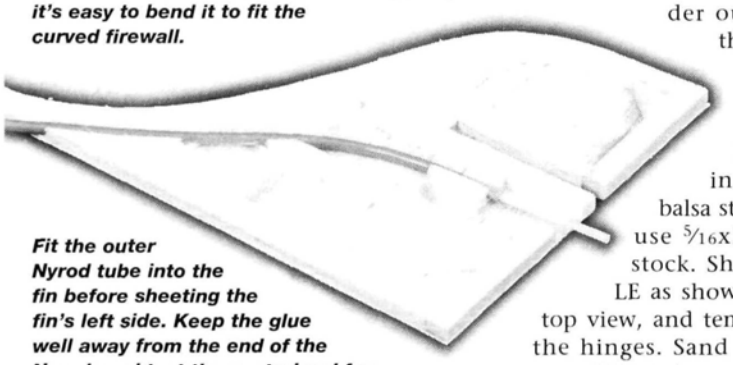
*With plywood reinforcements at all four corners, the formers are very strong—especially after they've been glued to the lite-ply sides—but they leave ample room for the servos, rods, gas tank, battery and receiver. The hardwood landing-gear blocks and triangle-stock reinforcements are partially visible on either side of former F3.*



*The firewall should not be installed until after the hole for the wing dowel has been drilled in former F2.*



*If you wet the 3/32-inch balsa sheeting first, it's easy to bend it to fit the curved firewall.*



*Fit the outer Nyrod tube into the fin before sheeting the fin's left side. Keep the glue well away from the end of the Nyrod, and test the control rod for smoothness of operation.*

balsa first, it will be easier to bend it around the firewall. When it has dried, sand it flush with the front surface of the firewall.

Sheet the turtle-deck area between formers F4 and F6 with 3/32-inch balsa; again, wet it first to make it easy to bend. Make a 5/16-inch-wide filler strip and pin it between former F6 and the tail post. Glue 1x3/8-inch balsa blocks to both sides of the filler strip, making sure that no CA touches the strip. Then shape and sand the blocks to taper them toward the tail post and to form a smooth extension of the turtle-deck sheeting.

• **Fin and stabilizer.** The tail components are unusual because the stab is slightly more than halfway along the fin. The two surfaces interlock to make a very sturdy unit. The elevator control rod is completely concealed inside the fin and must be installed during construction.

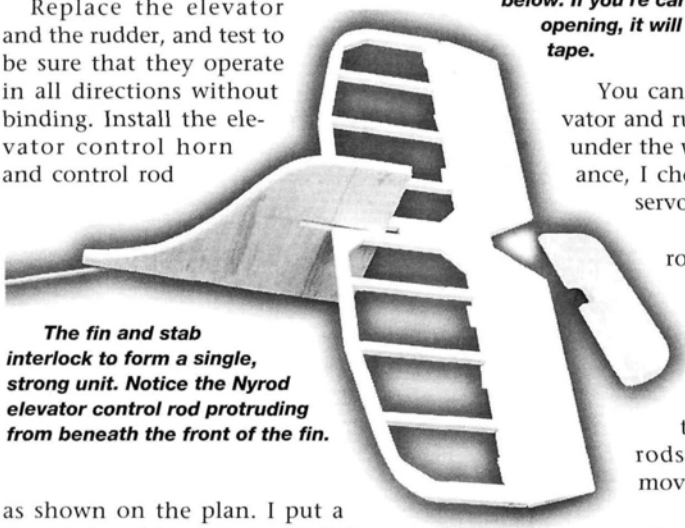
Begin by framing the fin with 1/4-inch-thick balsa. Next lay out a length of red, very flexible, Sullivan* Gold-N-Rod (Nyrod) roughly where shown on the plan. The exact path is not important, but the Nyrod must not bind. Mark the balsa strips where the Nyrod crosses them. Remove the fin from the board and sheet its right side with 1/32-inch balsa. Then pin the fin to a flat surface and carefully cut a channel in its framework to take the Nyrod ( see photo). When you cut the channel, cut out only a little balsa at a time and test-fit the Nyrod as you go to ensure a good fit. Install the Nyrod in the channel, making sure that it does not protrude above the surface of the fin's framework. Add a balsa gusset to help hold the tube in proper alignment, then CA it into place. Sheet the left side of the fin with 1/32-inch balsa, and round its LE with sandpaper. Do not cut the Nyrod that protrudes from the bottom of the fin; you'll cut it to the proper length later.

Make the rudder out of 5/16-inch-thick balsa sheet. If this thickness of wood isn't available, laminate 3/16-inch and 1/8-inch balsa stock together, or use 5/16x2-inch aileron stock. Shape the rudder LE as shown in the plan's top view, and temporarily install the hinges. Sand the fin/rudder assembly to shape.

The stab is built from 1/4-inch-thick balsa and is not sheeted. Cut the one-piece elevator out of 1/4-inch sheet, and install a 1/4-inch-square spruce stiffener on the center LE. Taper the elevator as shown on the plan, and hinge it temporarily to the stab. Sand the LE to a V-shape, and lightly sand the entire stab/elevator assembly.

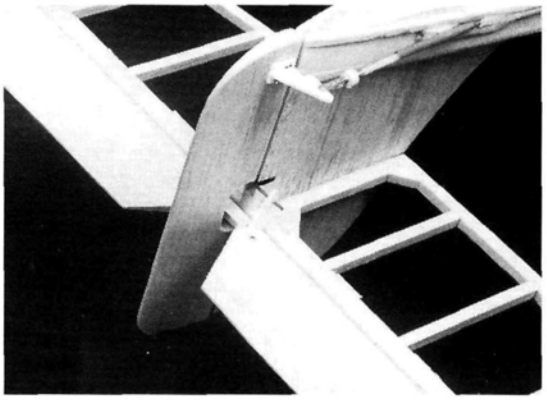
Remove the rudder and elevator, and assemble the fin and stabilizer as shown in the photos. Trim and sand them until they fit together snugly (use a square to ensure proper alignment), and then glue them together.

Replace the elevator and the rudder, and test to be sure that they operate in all directions without binding. Install the elevator control horn and control rod as shown on the plan. I put a threaded rod into the end of the Nyrod, bent it at a 90-degree angle and then inserted it into the middle hole of the elevator horn. Test the Nyrod to ensure a friction-free operation.

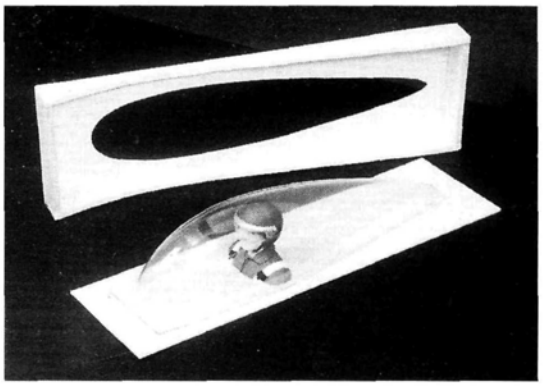


*The fin and stab interlock to form a single, strong unit. Notice the Nyrod elevator control rod protruding from beneath the front of the fin.*

Remove the 5/16-inch filler strip, and slide the fin into the slot. Route the Nyrod tube into the fuselage, and make sure the fin rests firmly against former F7 and the tail post so that the stab incidence is at zero. Align the fin perpendicular to the fuselage, and glue it into place. Slot the tail post to take the lowest hinge on the rudder.



*The elevator control rod is offset to clear the rudder. A conventional clevis would be too large to fit inside the fin, so the rudder linkage is a rod bent at 90 degrees that extends through the hole in the elevator control horn. The rudder control rod exits the fuselage on the right side.*



*The plastic canopy is slipped into the hatch top from below. If you're careful when you shape the opening, it will look neat—no glue or tape.*

You can install the throttle, elevator and rudder servos side by side under the wing, but for more clearance, I chose to place the throttle servo farther forward.

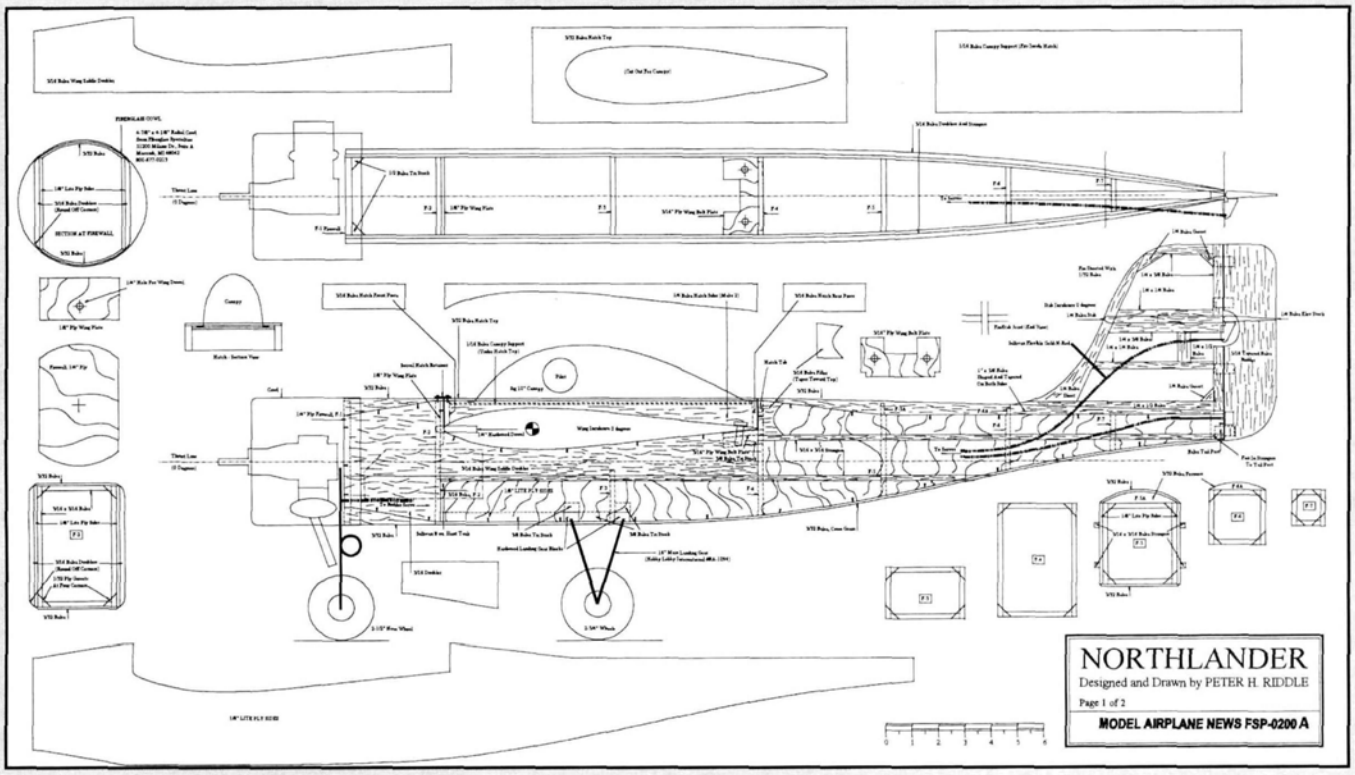
Install the control rods, and brace the tubes with scrap balsa inside the fuselage so that they will not be able to flex. Install the rudder horn; then install the control rods and check for proper movement.

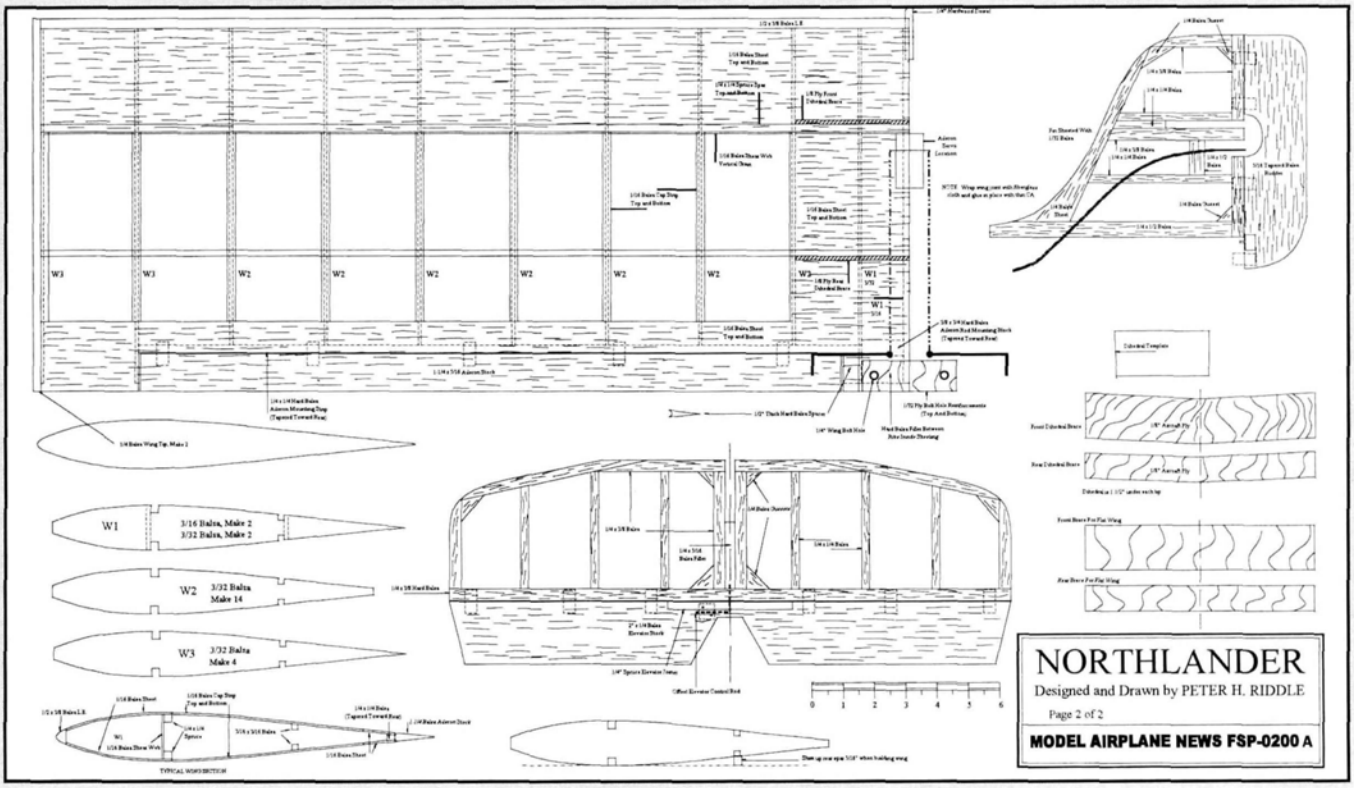
Install the engine and throttle linkage, then mark the fuel-line and vent-line locations on the

firewall. Wrap the fuel tank in foam and put it in the forward compartment. Add balsa supports to hold it in place; its centerline should be slightly below the carburetor. Temporarily install the main landing gear, install the wheels and adjust the nose gear to the proper height. Now remove all the hardware.

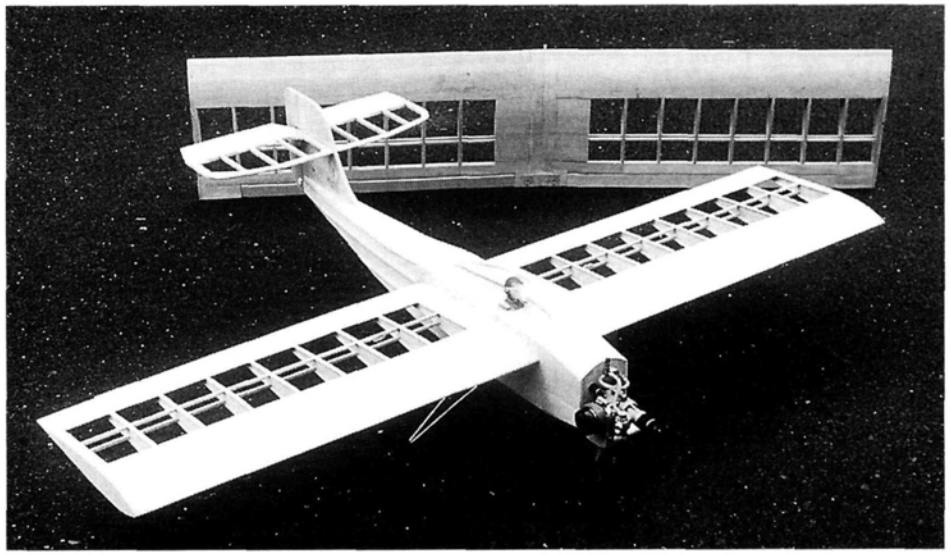
Drill the firewall for the fuel line and vent line. Sheet the rest of the fuselage bottom with 3/32-inch cross-grain balsa, and then sand the completed fuselage.

• **Hatch and canopy.** The hatch is designed so that you don't have to glue the canopy on the model. Start by cutting out the canopy's top, side and end pieces and its inner support, as shown on the plan. Cut the sides slightly oversize, then sand them for a precise fit between formers F2 and F4. Make the top opening slightly smaller than the outline shown on the template. Do not trim off the excess plastic around the bottom of the canopy, as this material holds the canopy in place. From underneath, slip the canopy into the opening, then trim the



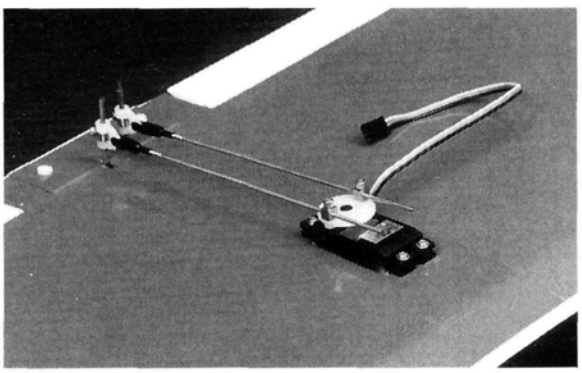

TO ORDER THE FULL-SIZE PLAN, FSP0200A, SEE PAGE 138.



*Here's the completed framework ready for covering. The flat wing has been installed, and the dihedral wing is shown behind.*

opening until the canopy slides in all the way. Don't make it fit too tightly, as the covering material will be lapped over the edges of the opening.

When you are satisfied with the canopy's fit, glue the top to the sides and end pieces. Bolt the wing firmly to the fuselage, and position the hatch on the wing. Trim and sand the hatch for a good fit, and allow just enough clearance to accommodate the covering material. Sand the sides and upper edges to blend in with the fuselage.



*A low-profile aileron servo fits neatly into the center of the wing; a standard servo will fit, too.*

Cut out the interior canopy support, decide where you want the pilot to be under the canopy, and temporarily attach it to the support with small screws. Insert the canopy into the hole, and follow this with the canopy support and the pilot. Fasten it temporarily with tape.

Glue a 3/16-inch-square balsa tab to the back of the hatch. This tab will slip under the top of former F4 to hold the hatch in place. Install some type of retainer at the forward end; I used a simple plastic swivel.

### FINISHING

Gently round off the fuselage edges and corners, and prepare the entire surface for covering by filling any dents and other imperfections and sanding with progressively finer sandpaper. Apply sanding sealant, then, when that has dried, sand with 220- and then 320-grit sandpaper. I covered the model with Coverite's* 21st Century fabric because it is easy to apply and goes on completely bubble free.

Install the control surfaces and put a few generous drops of CA onto each hinge. Seal the control-surface gaps with narrow strips of covering material. Reinstall the servos, control horns and control rods.

*Adjust the control throws as follows:*

- ailerons—1/4 inch up and down;
- elevator—3/8 inch up and down;
- rudder—1/2 inch left and right.

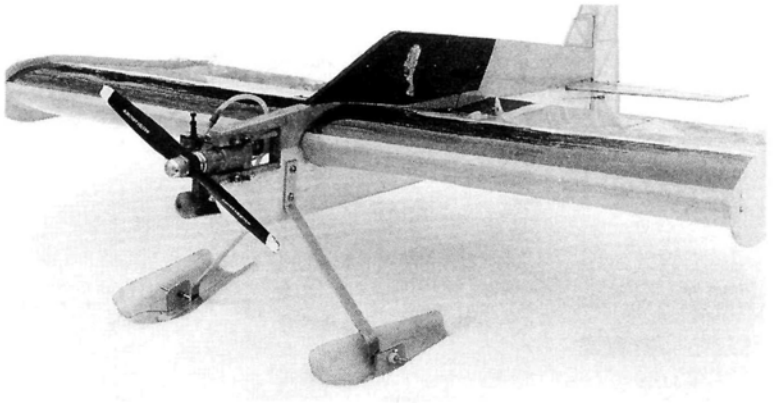
Install the engine and cut the fiberglass cowl to fit. Fasten the cowl into place with small screws driven into the firewall. I used 21st Century paint on the cowl to match the covering material.

Adjust the rudder-servo attachments so that the nose gear is lined up with the thrust line when the rudder is centered. Check the model's balance; the CG should be at the forward edge of the main spar. Move the battery and receiver around to adjust the balance, and add weight to the nose or tail if necessary. Also check the lateral balance and add stick-on weights to a wingtip if you have to. Then head for the field.

**Addresses are listed alphabetically in the Index of Manufacturers on page 142.*

# Make Soda Bottle Snow Skis

by Elson Shields

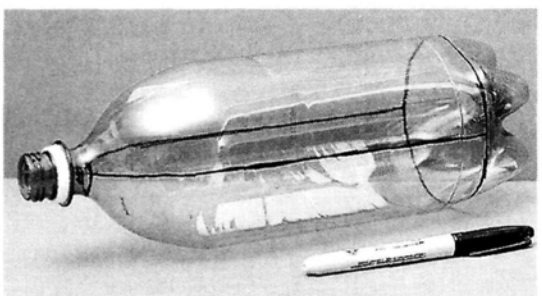


## Winter fun follows a trip to the recycling bin

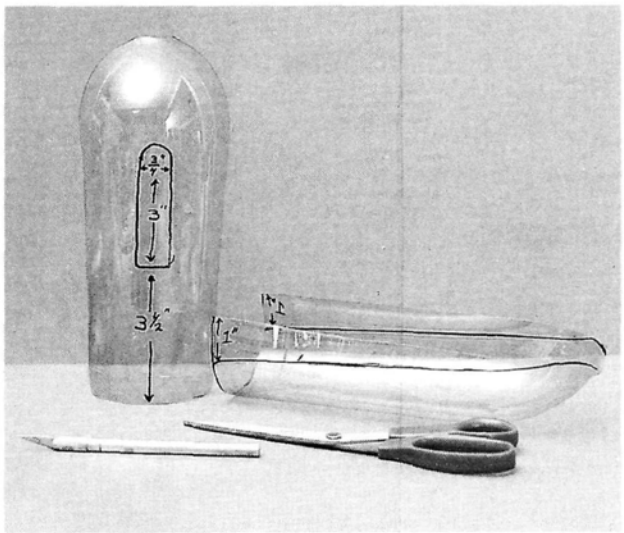
**Are you missing winter snow-flys because aluminum skis are too expensive? Do wooden skis require too much time to make? Are you tired of waiting to fly until the snow is packed down? Well, a 2-liter soda bottle, a trip to the scrap-wood box, a little glue, two steering arms and a couple of evenings are all that stand between you and great winter flying with a .40-size airplane.**

**1** You'll need very few things for this project: a 2-liter soda bottle (two, if you are prone to cutting errors); flexible, waterproof glue such as JZ Products'* RC-56 (epoxy will not work); a few pieces of lite-ply from the scrap box; and a couple of steering arms. The necessary tools include a ruler, a felt-tip pen and something to perforate the plastic bottle (I used a Top Flite* Woodpecker).

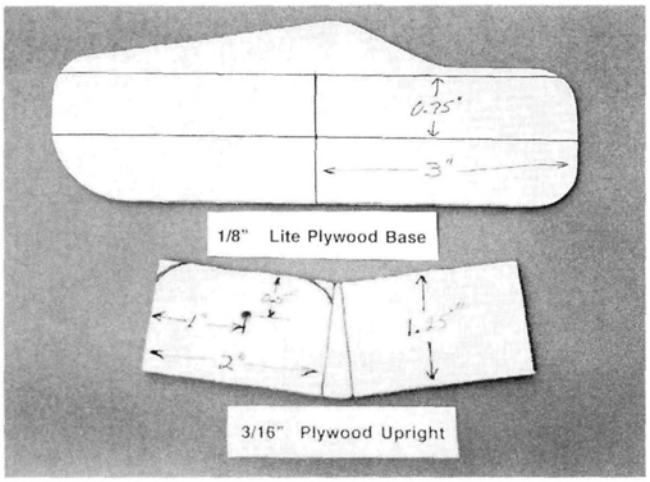

**2** Examine the soda bottle and find the two mold seams that run vertically along its length. Mark them with a felt-tip pen. In addition, mark a line around the base of the bottle where it gets thicker. The bottle in the picture has the cutting lines marked on it.



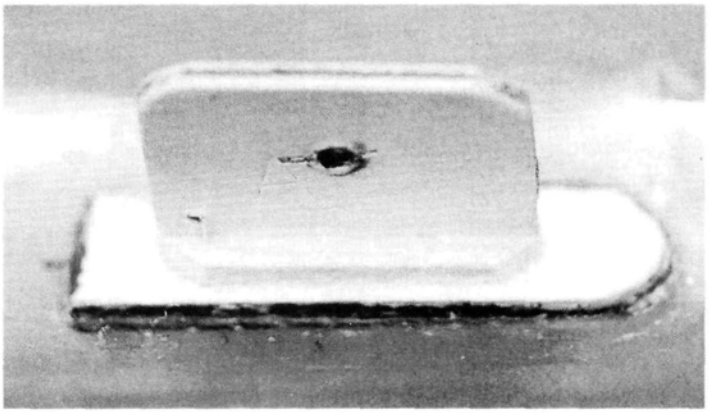
Begin by cutting off the bottleneck where it widens. The material here is very thick; you will need a hobby saw or hacksaw. Next, use a sharp hobby knife or scissors to remove the bottom of the bottle. It's easier to cut this material with sharp scissors than it is with a knife. Then, simply cut along the vertical seams, and you have two skis.



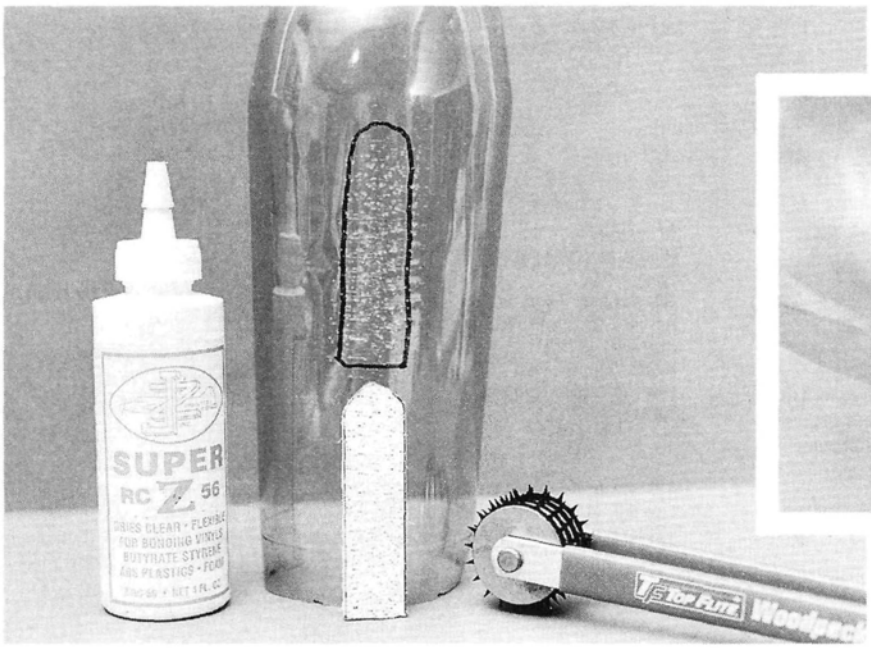

**3** The bottle on the right is an example of the rough-cut ski. I angled the rear of it downward to improve its looks. Note the line on the ski that shows where to make your cuts. Mark the area where the lite-ply plate will be glued, as shown on the left ski. The size and shape of this lite-ply piece is not critical, but it needs to be centered over the approximate CG of the ski.

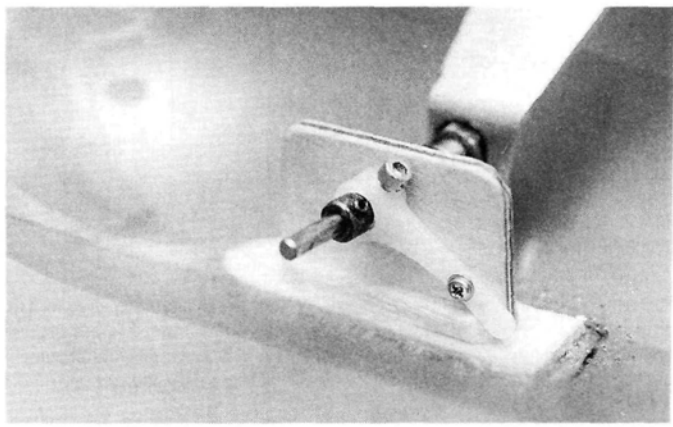



**4** The ski is attached to the landing gear with a plywood pylon. Cut the two, ¾x3-inch bottom plates out of ⅛-inch lite-ply. Remember to cut the bottom piece with the grain running lengthwise for maximum strength. The two vertical brackets are cut out of 3/16-inch plywood because lite-ply does not have the strength needed for the vertical bracket. Cut these 2x1¼-inch pieces with the grain running lengthwise.



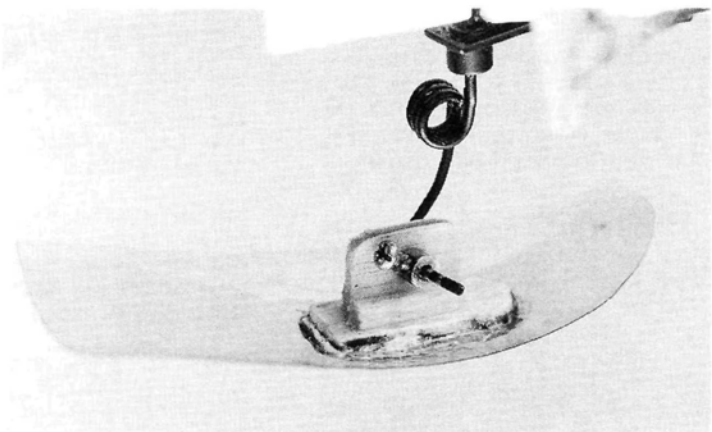
**6** Glue the vertical attachment to the bottom plate with 30-minute epoxy. You can reinforce the glue joint by adding pieces of 3/16-inch-square balsa stock to either side. Triangle stock would also work in this application. After the glue has cured, mark and drill the hole for the landing gear. Drill the hole just slightly in front of the ski CG so the tip of the ski will tend to lift during flight. Be careful not to make too large a hole; it needs to be the exact size of the landing gear.



**7** Use a steering arm to hold the ski in the proper position. On tail-dragger planes, set the skis parallel to the wing's incidence; tighten the steering arms to hold the skis in place. Add a wheel collar to help hold the ski on the landing gear.

**5** Before gluing the lite-ply base to the ski, perforate the area of the ski to which you will be gluing the base. Using the Top Flite Woodpecker, I placed the ski upside-down on a small box and perforated the gluing area from the outside of the ski to increase the gluing surface. To allow the glue to form a stronger bond, the ply plate needs to be roughened; I used the Woodpecker here as well. Use a flexible, waterproof glue to attach the ply plate to the ski. RC-56 worked best, but similar glues will also work. After applying a liberal coat of glue, clamp the plate to the ski and allow it to cure overnight. The most effective way to do this is to sit a 6-ounce can of tomato paste on its side on top of the plate, then clamp the whole arrangement to the table.



**8** You'll need to construct a smaller version of this ski for the tailwheel. Cut it out of the shoulder area of the bottle using the natural bend in the bottle for the nose of the ski. Planes with tricycle landing gear will need a third, full-size ski for the nose wheel. These skis are suitable for most .40-size airplanes. The skis shown have been used for two winters without a problem. The shape of the skis makes them more tolerant of soft, fluffy snow than aluminum or wooden skis. Skis fashioned out of 3-liter soda bottles would be suitable for .60-size airplanes.

**Addresses are listed alphabetically in the Index of Manufacturers on page 142.*



# Unusual subjects and burning rivets

In "Scale Techniques," there is no doubt that I tend to cover military scale more than civilian aircraft. This is because there's a plethora of WW I and WW II aircraft kits, plans—and now, ARFs—around, and the popularity of military aircraft is at an all-time high. Aerobatic subjects are also very popular these days, and scale aerobatic contests are being held just about everywhere. Attend one of these events, and you'll see enough CAP 232s, Extras, Giles and Pitts Specials to satisfy anyone's need for beautiful aircraft. A relatively new aerobatic design is the Staudacher S-300; I think it has attractive lines and good potential as a scale subject.

The almost-ready-to-cover (ARC) version of the S-300 from Giantscaleplanes.com, distributed by Hobbies & Helis Intl.*, is a 30-percent-scale copy of Jon Staudacher's S-300GS design with a 90-inch wingspan. The model comes out of the box framed up with its foam wings sheeted. The ailerons are already cut from the wing and are ready to hinge. The tail feathers are also factory built and ready to hinge. Even the wing-mount tubes are factory installed; this means you only have to cover it, install the ailerons and glue the alignment dowels into place to finish the wing.

The kit also has great-looking, gelcoated engine cowl and wheel pants, a molded plastic canopy, aluminum landing gear and a formed and tinted canopy. The Staudacher is designed for a 3.7 to 4.2ci gas engine, so something like a Zenoah G-62, a Brison 4.2, or a 3W 60 or 3W 70 would be perfect. And at a suggested weight of from 18 to 22 pounds, the model should be a true skyrocket in the performance department.

The nice thing about a 30-percent-scale aerobatic model like this is that you can fly it at IMAA, IMAC and AMA scale events. Boy, what a triple threat that would be. A number of bold color schemes are available for the Staudacher; take your pick.

***The 30-percent Staudacher S-300GS from Giantscaleplanes.com is an easy-to-assemble ARC model with good scale potential. Distributed by Hobbies & Helis Intl., the wood and foam-wing model has a 90-inch span.***

### MODEL GRAPHICS

A variety of commercial markings (decals) is available for model aircraft these days. Some modelers prefer water-transfer decals while others like dry, rub-on transfers. A few dedicated individuals paint all their markings using templates or ink pens. Vinyl rub-on or "stick-on" decals have also been used for a long time, but Butch Andrews of Model Graphics* has really perfected this type of decal.

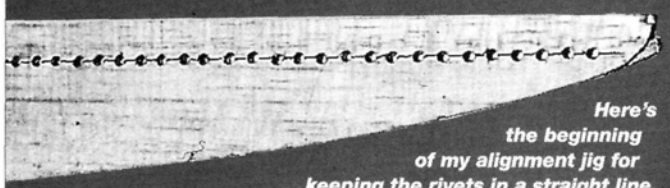
Butch uses premium-grade, 2-mil-thick vinyl that, when applied, feels and looks as though it were painted on. Butch recommends using Rapid Tac application fluid when you apply Model Graphics vinyl graphics. This allows the markings to be positioned more easily

## BURNING RIVETS

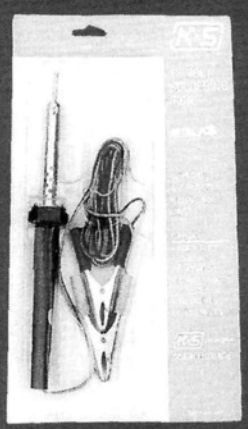
I have read many articles on applying flush rivet detail to model airplanes. While most of them explain much about the procedure, they often overlook the tools required to do the job.

I have a method for you to make your own tools, and it will cost only a few dollars. My scale technique for this month is how to make and use a rivet-burning tool.

The main ingredient is the old, reliable K&S* 12V soldering iron. This DC iron is intended for field use and requires a 12V automotive battery to operate. It comes with an ⅛-inch tip, and to make rivets, the soldering tip has to be replaced with a length of brass tube. For the most part, ⅛-inch-o.d. tube will produce rivet heads of the correct size for a 1/5- to ¼-scale model.



***Here's the beginning of my alignment jig for keeping the rivets in a straight line.***



***The 12V K&S soldering iron is inexpensive, and with a brass tube inserted into the tip, it's an excellent tool for making flush rivet details on your primed aircraft.***

To make the lines of rivets straight and uniform, you'll need to make a wooden holding jig to guide the hot brass tube as you burn the "rivets" into the model's surface. I find that a 6-inch-long piece of ⅛-inch balsa or 1/16-inch plywood works very well for a jig and can easily be fashioned from scrap wood.

Use a straightedge or ruler to draw a straight line on the piece of wood, then mark the line every ¼ inch along its length and drill an ⅛-inch hole at each mark. After you've drilled all the holes, use a knife or razor saw guided with a ruler to cut through the wood along the line. This leaves semicircles along the straight edge of the cut and forms a handy spacing gauge to guide you when you use the rivet-making tool.

than when they are dry. Once you have the graphic where you want it, squeegee out the fluid; your markings will be set.

If you send your scale documentation photos or drawings to Butch, he can reproduce the graphics and lettering to the exact size and shape you need. He uses computer scanning, CAD and graphic art software, and the results are beautiful. Model Graphics has many designs and markings in stock. If you have a special model and want great-looking markings, give Butch a call at (409) 787-2875.

***Right: my good friend Sal Urciuoli built this very unusual Blohm and Voss P-208. Below right: this German WW II aircraft has a 93-inch span and is powered with a SuperTigre 2500.***

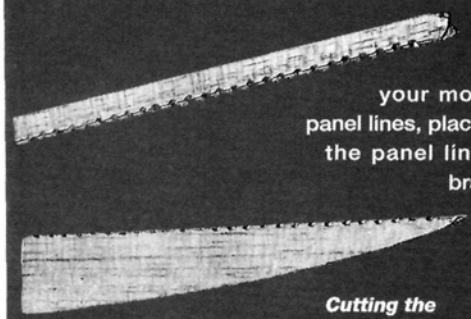

***Model Graphics offers a wide selection of vinyl, stick-on decals. Once applied, the decals look painted on.***

## BLOHM AND VOSS P-208

My friend Sal Urciuoli of Holbrook, NY, is always coming up with unusual warbird subjects. Last winter, he told me he was working on a special project: an unusual WW II German aircraft.

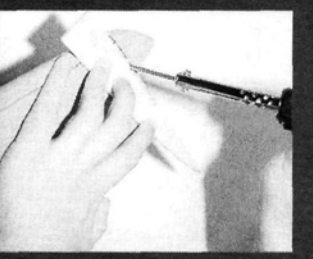
I met up with Sal at the '99 Warbirds over Long Island, and he showed me his original-design Blohm and Voss P-208. It has a 93-inch wingspan, weighs about 16 pounds and was designed for a Zenoah G-23 engine and a pusher prop for power. Spring Air* retracts support his wood-and-glass-cloth airplane.

I was impressed with his work, but I was a little skeptical about whether the aircraft would actually fly well. Seeing is believing, though, and the photos speak for themselves. The airplane is very stable in the air, and Sal is currently redesigning the landing gear to improve ground handling. To give the plane more power for takeoff, he also replaced the G-23 with a



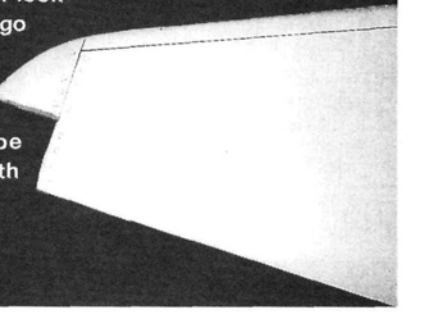
***Cutting the wood in half through the center of the holes produces the finished jig. The half-holes guide the riveting tool as you burn the rivets into place.***

After you've primed your model and added your panel lines, place the jig to one side of the panel line. Place the heated brass tube's tip in the jig and firmly press it into the surface. Hold it there for a split second, then pull it away. Continue until you've done about five rivets, then remove the tool and jig and check how the rivets look. Depending on the type and hardness of your primer coat, it may take more or less pressure and time to produce the desired rivet effect. Some modelers perform this procedure after the model has been painted, but I prefer to do it in the prime stage. Experiment on a piece of primed and finished scrap wood until you get the hang of it. Rivets are often located between panel lines, and if this is the case, use a pencil to lightly draw a guide line, then place the jig over the line and proceed as before.



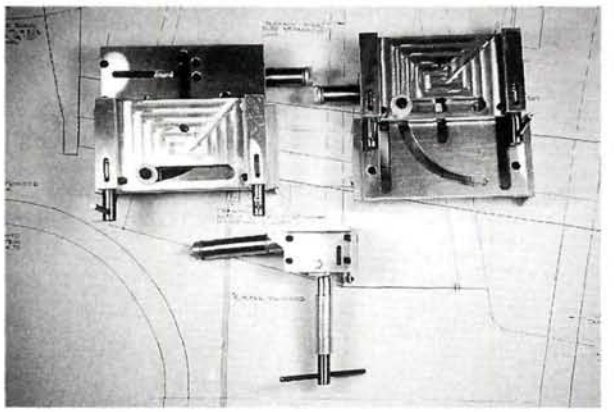
***Hold the jig in place next to the panel line (here, I drew it on with a pen for the photos) and press firmly for a split second. Move on to the next rivet and repeat until you have produced a row of rivets.***

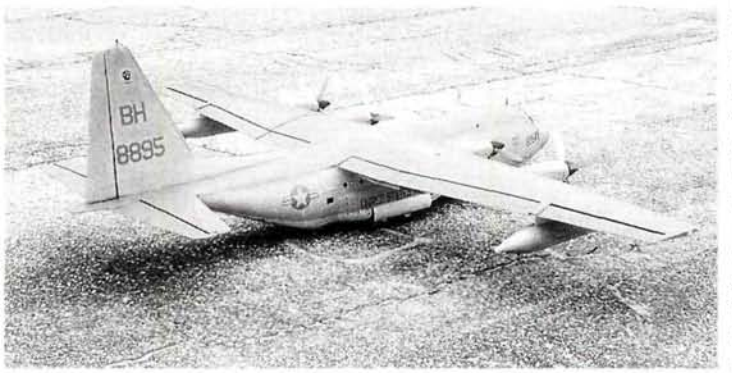
Remember, flush rivets were often imperfect. Do not be too bothered if your rivets are slightly off-center or not perfectly round; they will look more realistic that way. Now go ahead and do the rest of your model; you have a lot of work ahead of you, but the end result will be well worth it. Good luck with your project.



***Here are the finished rivets on the stab of my Midwest Texan. Experiment on a scrap piece of finished wood before committing to the model.***

SuperTigre* 2500. Sal said it can be nerve-racking to fly the P-208 because the wing configuration makes you wonder which way the model is flying. Having seen it fly, I salute Sal for his efforts; this is really scale modeling at its best.






***Above: the Herk has plug-in wing panels, and Jet Hangar Hobbies makes custom retracts for the model. Below: JHH has gone to props in a big way with its impressive C-130 Hercules transport and cargo aircraft.***

### JET HANGAR HOBBIES: NOT JUST JETS

Jet Hangar Hobbies (JHH)* is known for its excellent flying ducted-fan and turbine-powered jet kits and accessories. Most of these jet designs are in the 45- to 58-inch-wingspan range, and this makes them very user-friendly—especially if you have a small car. For something completely different, JHH is offering a Lockheed C-130E Hercules transport designed for four .90 to 1.08 engines. The "Herk" has a 133-inch wingspan and is 100 inches long. JHH has custom scale retracts for the C-130 and says that the model can carry a 10-pound payload.

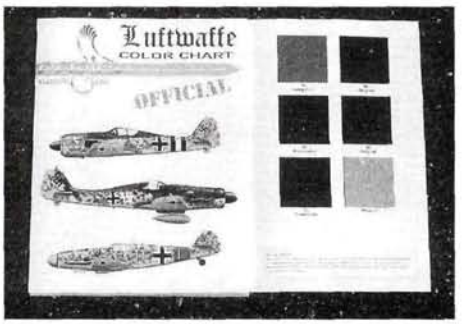
Included in the kit are foam wings, stab and dorsal-fin cores. For easy transportation, the wings panels are removable at the inboard nacelles. The epoxy/glass fuselage comes in three pieces. While JHH calls this a partial kit, it comes with sheet drawings with simplified construction techniques and suggested servo locations. To make this a complete kit, all wood, hardware and accessories are available from JHH.

Most of the large, four-engine designs I see at warbird events are WW II bombers, so the C-130 is a welcome change. Many scale paint schemes are available for the Hercules, from the Vietnam era to the aircraft still used by the Air Force Reserve units today. The Blue Angels and the Thunderbirds airshow teams also use C-130s, and these would make greatly colorful subjects, too. Gee, I think I just talked myself into another winter project!

### LUFTWAFFE COLOR CHART

Many of you have written to me requesting a source for color chips or paint charts, especially for German WW II aircraft. A number of good paint charts are available in the market, but a new Luftwaffe color chart is now available from Eagle Editions Ltd.*

The paint chips used in the Eagle Editions Ltd. chart are manufactured by Warnecke & Bohm, one of the original suppliers of aircraft paint to the Luftwaffe. The trifold chart measures 11x24 inches and contains 30, 2-inch-square paint chips, including late-War colors. Printed on the back is a certificate of authenticity.




***The paint chart from Eagle Editions Ltd. contains excellent color chips for WW II Luftwaffe aircraft. I haven't seen any better!***

Scale documentation requires a "color and marking" section, and these color chips certainly will aid in the first part of that section. I think they are well worth your consideration.

**Addresses are listed alphabetically in the Index of Manufacturers on page 142.* ✦

 by Rick Bell

# Winter maintenance

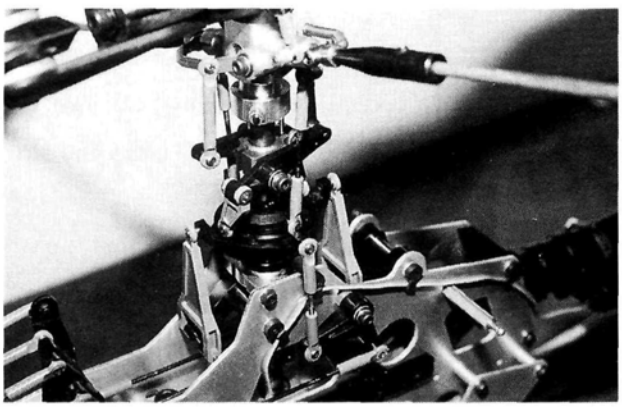
By the time you read this, we Northeasterners will be in the midst of winter and experiencing the dreaded downtime that accompanies it. I use this downtime, however, to ensure that my helis remain safe and trouble free by making certain that everything is shipshape and ready to go when flying season returns. Because they have more moving parts and vibration sources (just like full-scale helicopters), our model helis need more maintenance and attention to detail than do fixed-wing models. So clean off your workbench, grab a cup of coffee and let's get started.

***Winter downtime gives you a good opportunity to check the condition of your heli. Make certain now that everything is in tip-top shape, and that first flight in the spring will be even safer and more enjoyable.***

## PREVENTIVE MAINTENANCE

Before you store your heli for the winter, remove all the fuel from the tank, and charge the batteries. To keep batteries in top condition, cycle them once a month during the off season. I use a logbook to track my batteries' performance, and I recommend that you do this, too.

I start by giving the heli a thorough cleaning. Remove the canopy and main rotor blades, then clean every nook and cranny using a rag, a small screwdriver and some household cleaner. Remove all the oil, grease and dirt build-up. To thoroughly clean them and inspect the bearings, some areas of the heli will have to be disassembled. If you put in a lot of time on your machine, all the bearings should be removed and checked for smoothness then regreased as necessary. A rough bearing will cause vibration and will eventually fail.



***Helis are full of ball-link connections. All the links should be removed and cleaned, then checked for proper fit—neither too loose nor too tight.***

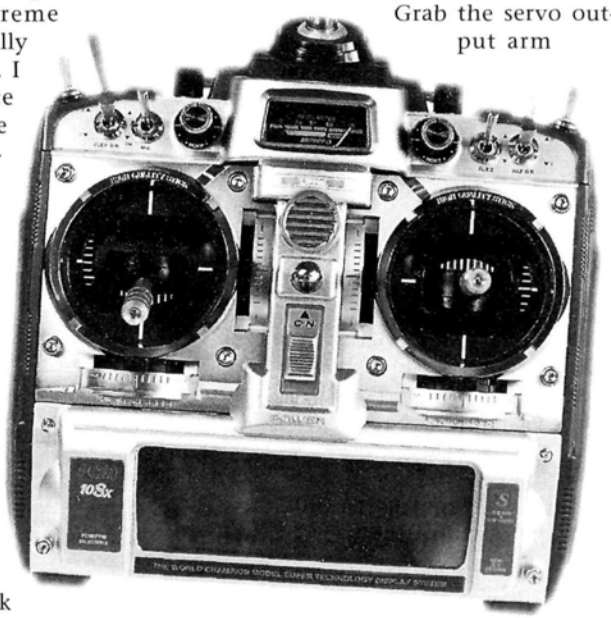
After the heli is nice and clean, I check all the pushrods and ball links for wear. Remove the ball links and clean them, then check them for smoothness; they should not be too tight or sloppy. If the bearing has a lot of slop, replace it. One linkage that needs special attention is the throttle pushrod. Because it's attached directly to the engine, it's subject to extreme vibration; it really takes a beating. I usually replace the link and the ball on the carburetor arm.

Once all the links have been cleaned and inspected, reattach the pushrods, but not to the servos. Move the linkage by hand and check for binding or excess slop. Now is the time to make any necessary repairs. When you've finished, check the servo arms for cracks. Replace any defective arms but be sure to replace them with arms of the same size.

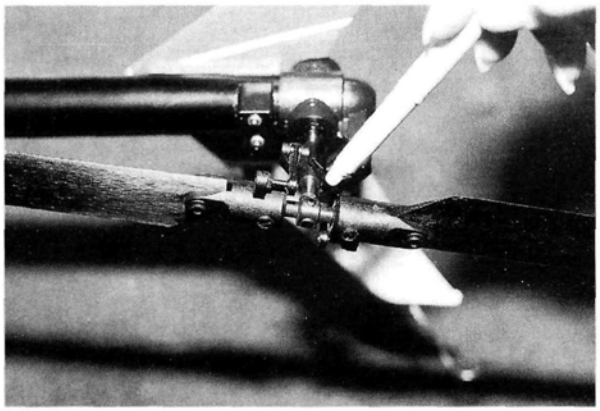
If your pushrods have Z-bends, now is a good time to upgrade them by adding ball links. Over time, Z-bends wear out the holes in the servo arms, and this reduces control precision.

## SERVO AND RADIO CHECK

Check the mounting screws, and tighten any that are loose. Grab the servo output arm



***Your transmitter is a major investment; give it a good cleaning, too. Use cotton swabs to remove all the dirt and grime that seem to creep into its nooks and crannies. Cycle your radio's batteries, too.***



***The tail rotor is subject to much stress and should be completely disassembled and inspected, as should the drive belt or drive wire.***

and check for wear or slop in the servo spines. Check the servo lead wires, and look for any that might be frayed or chafed from rubbing against the frame. Replace any defective servos. While in the radio area, check the gyro wiring and connectors for wear. If you use a mechanical gyro, remove its outer case and make certain the springs are tight.

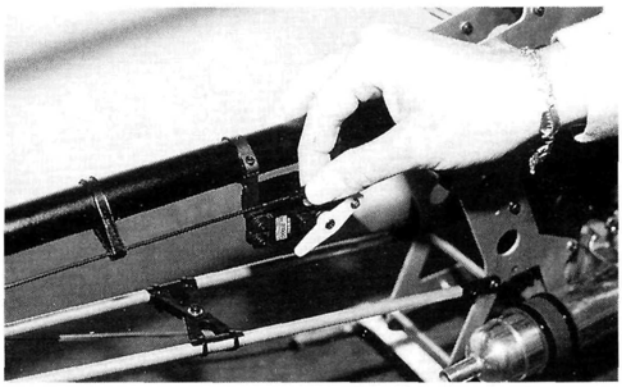
All newer helis use composite servo trays; check them for cracks. If your heli has wooden servo trays, check all the glue joints and reglue any that are suspect.

### FRAME, BOOM AND TAIL ROTOR

Loose bolts are another source of vibration. Check all the nuts and bolts that hold the frames together, and tighten any that are loose. Also look for cracks, especially around the engine and landing-gear mounts. These areas are subject to high stress and vibration.

After I've checked the frames, I remove the tail boom and inspect the drive system. If the heli uses a belt to drive the tail rotor, check it for wear. If the heli uses a wire drive, remove the wire and clean out any old grease and then relubricate it before replacing it. For torque-tube drive systems, check the support bearings for smoothness, and make sure that the drive ends are secure.

It is very important to check the tail rotor and gearbox. Remove and disassemble it, check the bearings and relubricate the gears. The setscrews holding the tail-rotor hub to the shaft should be checked for security and retightened if necessary. Check all the links for slop or binding. I also disassemble the tail-rotor blades' grips, and I check the thrust bearings for wear then relubricate them before I put them back together. The tail-rotor blades and tail fins should also be inspected for cracks or other damage. Replace any defective parts.

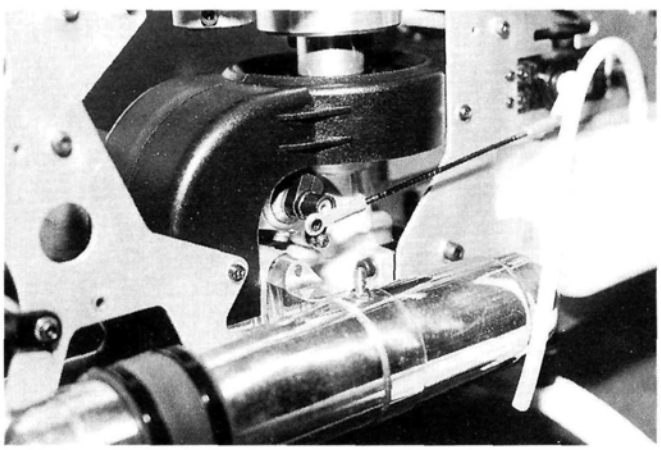


***All pushrods should be manually checked for binding. Here, the tail-rotor pushrod has been removed from the servo and is being checked. It should operate smoothly.***

### MAIN ROTOR HEAD

Because the main rotor head is the most important part of any helicopter, I completely disassemble it for inspection. I start with the bearings and check them for smoothness, especially the thrust bearings; they take quite a load. I clean them, and I use a magnifying glass to inspect the grooves in the races. I check for dents or pockets that prevent the bearing from turning smoothly. If any are less than perfect, I replace them.

Once I'm satisfied with the bearings, I check the feathering shaft for straightness and wear and the blade grips for signs of stress. I check the blade-retaining bolts by placing them in a drill and spinning them to see whether they are bent; if they are, I replace them. I also check the flybar and its paddles and all the pushrods and associated links.



***Special attention should be paid to the throttle ball link and ball attachment. The one shown here has a fairly worn link and needs to be replaced.***

### MAIN ROTOR BLADES

Thoroughly inspect the main rotor blades for cracks or other defects. Inspect the root reinforcements and make sure that they are tight and secure. If the blades are suspect in any way, discard and replace them. This is especially important if your blades are of composite construction. Do not attempt to repair composite blades!

While the rotor head is off the heli, remove the main shaft and check it for wear and straightness. After I rebuild the main rotor head, I rebalance it before installing it on the heli.

### FUEL TANK AND PLUMBING

Nothing is more frustrating than trying to track down a fuel problem. High-nitro-content fuels are hard on fuel lines, so to avoid any springtime problems, I replace all of them, inside and out. Also make sure that the pick-up clunk is securely attached to the pick-up fuel line. This is especially important if you do aerobatics.

### GEAR AND CANOPY

Check the landing-gear skids for cracks and damage; replace them if necessary. Check the canopy for cracks and split seams. The canopy-mounting grommets are subject to wear, so check them as well. Make any repairs and touch up the paint as necessary for that new look.

It is very important to use the instruction manual to reassemble everything you took apart. Don't rely on your memory; you could miss something important. Once the heli has been reassembled, do a preflight inspection. Check that all servos move in the correct directions and that the gyro is operating properly; leave nothing to chance.

When you've finished, your machine will be ready for the new flying season, and you'll know that everything is as it should be; then you can concentrate on flying. Until next time—fly safely and with purpose. ✈

MODEL AIRPLANE NEWS
FIELD & BENCH
REVIEW

# Cermark BOBCAT

by Rick Bell

"You've come a long way, baby!" is one of those catchy advertising slogans that says a great deal, especially when you're talking about today's generation of ARF (almost-ready-to-fly) aircraft. From trainers to high-performance aerobats, warbirds and everything in between, there is an ARF for everyone. ARFs provide a quick means to get into the air for modelers who are short on time or who lack the necessary building skills to achieve their modeling goals. Cermark's* entry into the ARF arena—the Bobcat—raises the ante by coming even closer to being a true ARF.

## SPECIFICATIONS

**Model**: Bobcat

**Type**: low-wing ARF

**Manufacturer**: Cermark

**Wingspan**: 57 in.

**Length**: 48 in.

**Weight**: 5.5 lb.

**Engine supplied**: Thunder Tiger GP .42

**No. of channels req'd**: 4

**Radio used**: JR* X388S

**Price**: $299.99

**Features**: completely built, all-wood, low-wing ARF covered with Ultracote. The Bobcat is one of the more complete ARFs out there; it includes everything except transmitter, receiver, battery pack, switch harness, aileron extension and glow plug.

**Comments**: the Cermark Bobcat ARF is a well-built, high-performance, low-wing flyer. With its very short assembly time and just about everything factory installed, it's possible to buy the kit on Friday and be in the air on Saturday morning. The Bobcat's fine flying qualities make it a great Sunday flyer.

**Hits**
- Nicely built and covered.
- Quick assembly.
- Servos, pushrods, motor and plumbed tank are factory installed.
- Fun to fly with excellent characteristics.

**Misses**
- Engine should come with a glow plug.

### WHAT'S IN THE BOX?

Well ... just about everything! This is one of the most complete ARFs on the market today. If you are looking for a project that will take some effort to complete, look elsewhere, because this great-looking, high-quality, all-wood plane comes completely built and is already covered and trimmed with Ultracote*. The servo tray, servos, pushrods, plumbed fuel tank and nose gear are all factory installed, as is the Thunder Tiger* GP .42 engine with the muffler and cowl. All control surfaces are slotted, so they are ready for the provided CA hinges, and all control horns are already installed. Even the wheels are mounted on the gear legs!

So what's left? Just a bit of assembly (construction does not even apply here!) that takes only a few hours. You will need to provide your own transmitter, receiver, switch harness, battery pack, aileron extension, glow plug and epoxy, but everything else is in the box. No plans are provided, but they aren't needed. The instruction sheet guides you through the assembly in a logical

# A TRUE ARF AND AEROBAT

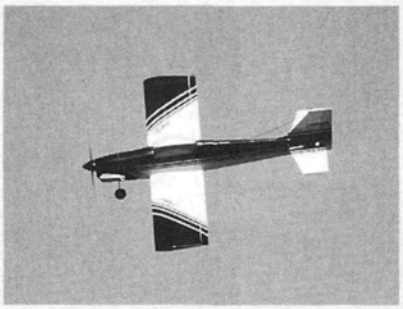
## FLIGHT PERFORMANCE

Before the Bobcat's first flight, I ran a few tanks of fuel through the GP .42 to break it in and set up the idle. Once I had finished this, it was ready to go.

**• TAKEOFF AND LANDING**

Given that the Bobcat has a conventional gear layout, I didn't expect any surprises during taxi tests or takeoff. After testing it on the ground, the moment had arrived! I advanced the throttle, and the Bobcat moved out smartly and was flying in no time without any problems.

Line it up on the centerline, reduce throttle and let it settle in. The Bobcat flares nicely for those greased-in touchdowns that make you feel really good.



**• LOW-SPEED FLIGHT**

I made a few laps around the patch to get used to the control responses and to adjust the trims, which needed only minimal changes. It was immediately apparent that the Bobcat was a great airplane. I checked its stall characteristics and found no bad habits; it just gently breaks to either direction and mushes forward. Applying throttle quickly gets it flying again.

**• HIGH-SPEED FLIGHT**

This plane is rock-solid at high speeds. I noticed no bad characteristics in its flight and felt that it handled well with no surprises.

**• AEROBATICS**

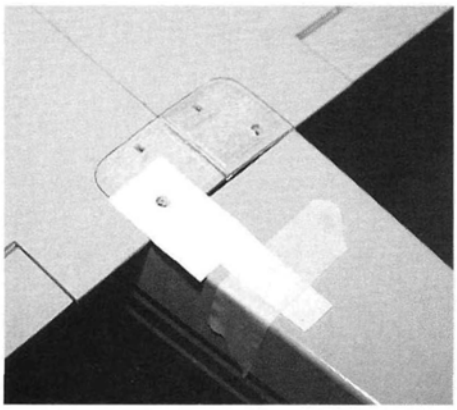
The Bobcat is a sport pilot's dream ship; aerobatics are easy. Loops can be as big and as round as you want. Rolls are axial with minimal elevator input. Snaps are just that—a snap—and spins stop on command. Inverted flight requires some down-elevator to hold level flight. It was a nice surprise that the Bobcat does knife-edge so well; it made passes the length of the field with hardly any coupling. All in all, the Bobcat is a great Sunday flyer.

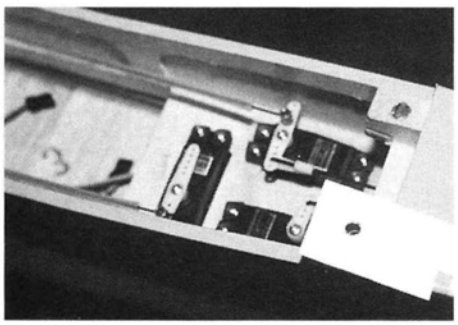
order with only a couple of areas that need special attention; I'll highlight them.

### ASSEMBLY

For me, assembly of any ARF begins with plugging in my covering iron to remove those wrinkles that always seem to pop up. The Bobcat had just a few wrinkles, and they were quickly and easily removed.

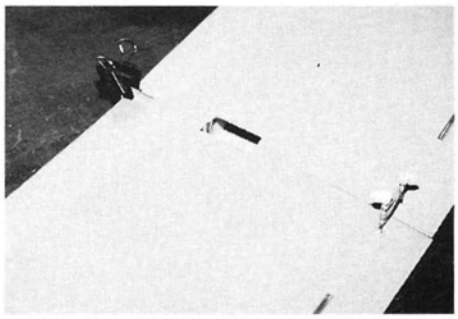
The first step on the instruction sheet is to join the wing panels using the supplied plywood dihedral brace. For this project, I used Anchor Bond* epoxy. First, I checked the fit of the dihedral brace in its slot and how well the wing fit together. For a perfect fit, I only needed to sand the root ribs slightly. I used tape to hold the wing panels together while the epoxy cured. I also used a paper spring clamp on the tongue and wrapped rubber bands around the aileron torque rods to provide better clamping. When you join the wing, make sure that the wing panels are aligned and straight before the epoxy cures.





***Left and below left: a piece of cardboard and some tape can make it incredibly simple to drill the wing-mounting holes.***

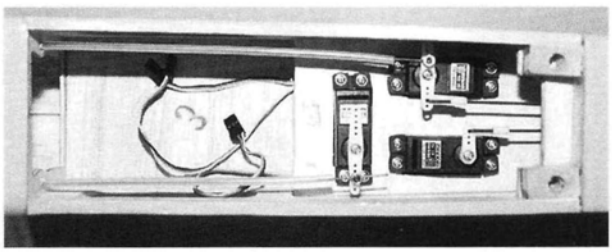
***Below right: to ensure a strong join, make sure you clamp the wing halves together tightly while the epoxy dries. Rubber bands and paper spring clamps can help greatly.***



At this point, you must mount the aileron servo tray in the wing. The hole for it is precut, so you need only cut away the covering where the tray will be epoxied. The included aileron servo can now be mounted, and you can also hinge the ailerons. The instructions do not say that you should epoxy the torque rods to the ailerons, but it is necessary; make sure you don't forget. Using the supplied hardware, connect the aileron pushrods and install the landing gear.

Be sure to remove the Ultracote on the wing where the precovered wing hold-down plate goes, then epoxy the plate into place. You'll need to drill holes in this plate, and it may be difficult. To simplify the process, take a strip of thin cardboard and make a hole in it that's the size of the wing bolt. Then screw the bolt into the fuselage, fastening down the cardboard strip. Place a piece of tape on the trailing edge of the strip to fasten it to the fuselage, and remove the wing bolt. Slide the wing underneath the cardboard. The hole in the strip now shows you where to drill the holes in the wing without any guesswork! Be sure to align the wing to the fuselage before drilling the bolt holes. This completes the wing assembly.

The tail feathers are next. Epoxy them into place, again making sure you remove any covering where a strong joint is required. After the stabilizer, install the vertical fin. I was able to achieve the proper stab and fin alignment without tweaking the fuselage slots. When the epoxy had cured, I added the elevators and rudder and hooked them up to the factory-installed pushrods. Finally, you need to glue the canopy tub and then the canopy into place, and the Bobcat is officially assembled. Wow! Only a couple of hours, and I had a plane that was almost ready to go!



***Pop in your receiver and check to make sure that the servo grommets are around (not under) your servos, and you've finished a great deal of the assembly.***

### SETUP AND FINAL CHECKS

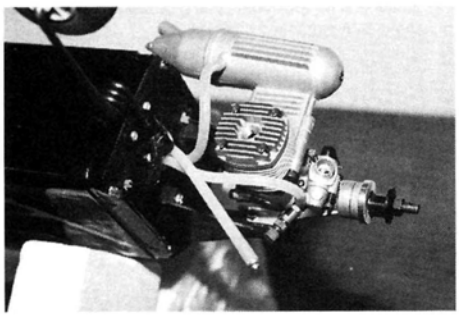
Because all of the major components were factory installed, now was the time to

check everything, starting at the nose and working backwards. The engine mount, engine, tank and muffler were tight and secure. The tank was properly plumbed and hooked up to the motor and muffler. Impressive! I only had to rotate the muffler outlet to direct the exhaust away from the fuselage. I checked the servos next, and I found that the grommets were installed under the servo-mount lugs instead of around them. I quickly corrected this. Next came the pushrod assemblies and the control horns; they were all OK. When I was satisfied with everything, I mounted my switch and receiver and slid the battery pack under the fuel tank.

You need to set up the control throws next. The instruction sheet lists the throws by degrees. Place a protractor on the centerline of the control surface, and you can easily convert degrees to inches as follows: elevator—10 to 15 degrees (⅜ to ½ inch); ailerons—15 to 20 degrees (¼ to ⅝ inch); and rudder—20 to 25 degrees (1 to 1¼ inches). These throws worked out fine as low and high dual rates.

The Bobcat was now ready to be balanced. The recommended CG is 2½ to 3 inches from the leading edge of the wing. Using my Great Planes* Balance Machine, I found the Bobcat to be slightly tail-heavy. Since I was using a 700mAh battery up front, I needed 2 ounces of lead in the nose to bring the CG within the set limits. I'm sure that using a larger battery would eliminate the need for nose weight.

## FINAL THOUGHTS



***My Thunder Tiger GP .42 fits great in my Bobcat and gives it ample power to perform aerobatics.***

The Cermark Bobcat ARF has created a new dimension within the ARF market. Its construction, factory-installed components, ease of assembly and great flight performance all make this kit an outstanding value. The supplied servos, motor and hardware proved to be nearly a perfect match for the airframe and worked very well. ARFs have indeed come a long way, baby!

**Addresses are listed alphabetically in the Index of Manufacturers on page 142.*

# MODEL AIRPLANE NEWS CLASSIFIEDS

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## BUSINESS

**WANTED:** 1950s plans for Mechanix Illustrated "snark" missile; Jetex-powered catapult launch. Fred Richmond, 324 Hills St., Chittenango, NY 13037. [03/00]

**MODEL FLYER—A NEW AEROMODELLING MAGAZINE** edited by David Boddington. This monthly magazine offers all types of readers articles on how to improve their skills, save money, update their models and enhance their enjoyment. For a 1-year subscription, send $62 check, payable to "Wise Owl Worldwide Publications," 1926 S. Pacific Coast Hwy., Ste. 204-MAN, Redondo Beach, CA 90277; (310) 944-5033. [04/00]

**WING WRAPS.** The safe way to transport wings to the field without damage. Call Hobby Gear, (218) 829-9255; website: www.hobbygear.com. [03/00]

**DAVE PLATT'S "BLACK ART"** videotapes are now all available. "Building and Fiberglassing," Vols. 1, 2 and 3, and "Detailing and Painting," Vols. 1, 2 and 3. If you're into scale, or want to be, send an SASE for free leaflet to Dave Platt Models, 1306 Havre NW, Palm Bay, FL 32907; (321) 724-2144. [4/00]

**GAS ENGINE CONVERSIONS.** Kits and parts: Homelite, Weedeater, Ryobi, McCulloch, Honda. Information, $5. Visa/MC. Carr Precision, 6040 N. Cutter Cir., #303, Portland, OR 97217; (503) 735-9980; fax (503) 285-0553. Email: carrprecision@worldnet.att.net; website: http://www.carr-precision.com. [2/00]

**WANTED: ALL TOY METAL OUTBOARD MOTORS.** Electric, wind-up and gas. Also wanted: .60-size spark ignition motors, thimble drone, etc., racecars. Call Richard, (231) 941-2111. [02/01]

**NEW AIRPLANE KIT.** Complete, includes tools and additional material. Value $600, will sell for ½ price. ¼-scale clipped wing Taylorcraft (Duane Craft), wingspan: 90 in., length: 69 in. Tools—sealing iron, saw. Materials—MonoKote, white pearl 6' Epoxy glue. Call Katrin, (212) 678-6928; voice mail (212) 802-7671, or email kgrotepass@aol.com. [02/00]

**BUILD MODEL WARPLANE WIND VANES!** 50 great models! Website www.windmodel.com. Info: Windmodel, Box 410, Syracuse, NY 13206-0410; email riks@a-znet.com. [04/00]

**HIGH-QUALITY LASER-CUT PROFILE AND SCALE KITS.** For more information, send SASE to Hoemcraft Aviation, 1204 S. 4th, Independence, OR 97351; website http://hometown.aol.com/hoemcraft/aviation.html; email: hoemcraft@aol.com. [04/00]

**EVERYTHING ABOUT EXTRA AIRCRAFT—ON THE WEB.** Aero Sport, Inc., the North American distributor of Extra Aircraft and the FBO of the St. Augustine, FL, airport, has a new website featuring an online store with Extra logo sportswear and aviation-related items; free digital postcards; downloadable aircraft photos: Extra 3-views and free screensaver. www.aerosport.com. [4/00]

**OTT-LITE TRUE COLOR LAMPS FOR YOUR SHOP.** Bright, glare-free, perfect for color matching, CRI=95. Bring full spectrum daylight illumination inside! Discount prices! www.lumenlight.com. [3/00]

**KNEE CUSHION**: 12x22x1½-in. medium-density foam. Great for pit area. Only $12.95. We also have a heavy-duty knee cushion for $39.95. http://www.autovations.net, or (203) 746-8772. [3/00]

**PILOTS BY DIANE**—all sizes. 1/7 to 1/3 regular line, or special orders like Patty Wagstaff or Flying Farmers. Color brochure available. (450) 246-4543. [5/00]

**1st U.S. R/C FLIGHT SCHOOL**: systematic 5-day hands-on flight-training courses through solo. More than 750 people trained—12 years running. Send for free brochure, or send $3 for complete information package. 86 16th St., Clintonville, WI 54929; (715) 823-2151; rcfs@frontiernet.net; www.frontiernet.net/~rcfs. [2/00]

**"AM I IMPRESSED? YOU BET!"**—review, *Model Airplane News,* November 1998. MINIATURE PLUNGE ROUTER BASE AND TEMPLATE GUIDE BASE. Version for Dremel, Ryobi, Foredom. Unprecedented accuracy and smoothness of cut. Bishop Cochran, http://www.bishopcochran.com; (503)231-5694. [5/00]

**R/C MODEL AIRPLANE SCHOOL.** Have you been trying to fly R/C model airplanes but haven't soloed yet? Do you find the "buddy-cord" system frustrating? Then come to Hobbies Aloft R/C Flight School and truly learn how to fly (read: land) R/C airplanes. All equipment is provided, so bring your own plane if you want, but leave your buddy-cord at home. Bring the family and enjoy the beautiful Monterey Peninsula on the central California coast while you learn to fly solo. Call toll-free (888) 700-4421, and visit our website at: www.hobbies-aloft.com. [2/00]

**DESCRAMBLE CABLE OR SATELLITE!** Only $14.95! (Satellite $19.95) Get all channels! Why pay hundreds? (800) 752-1389. [2/00]

**PAYING TOP $$$ FOR NEW & USED ENGINES:** buy, sell, trade. SASE for current list. Send trade-ins with $4 return postage to: GCBM R/C Models, 5009 Fairdale, Pasadena, TX 77505; (281) 998-2529. [2/00]

**PLANS-R/C SAILPLANES, SCALE, SPORT & ELECTRIC.** Old-timer nostalgia and FF scale and sport-powered, rubber and towline. All models illustrated. Catalog $2. Cirrus Aviation, PO Box 7093, Depot 4, Victoria, BC V9B 4Z2 Canada. [5/00]

**QUARTER SCALE "FLEET MODEL 2"** and 1/8 Electric FLEET kits. Concept Models, 2906 Grandview Blvd., Madison, WI 53713. SASE for details. www.mailbag.com/users/conceptmodels. [5/00]

**MODELS CUSTOM BUILT:** anything that flies. Kits, plans, developed, framed or finished. Test flown if desired. Currently building Bridi T6, Cook Phantom, Japanese Kate, Grumman Duck, Yellow F-18. PVB Custom Building, 384 County Rd. 21, Orrville, AL 36767; phone (334) 996-9418. [2/00]

**MAKE REAL DECALS** with your computer and printer. Send $10 for introductory kit to: LABCO, Dept. MAN, 27563 Dover, Warren, MI 48093; website: http://www.mich.com/~labco/ [8/00]

**DAVE PLATT R/C SCALE MODELS** are the ones you read about in the magazine contest reports. This is because scale experts know that Platt kits get the best static and flying scores. If you're a scale expert, or would like to be one, a Platt kit will put your name up there too. Send $1 for catalog to: Dave Platt Models, 1306 Havre N.W., Palm Bay, FL 32907; (321) 724-2144. [7/00]

**GIANT-SCALE PLANS BY HOSTETLER**—catalog $2 (plus SASE) to Hostetler's Plans, 1041 Heatherwood Ln., Orrville, OH 44667; (330) 682-8896. Our plans are now available in any size and scale. Website: www.aerosports.com/whplans. [3/00]

**MAKE YOUR OWN ROCKET MOTORS!!!** Homemade solid and composite fuels, power R/C gliders, model rockets, etc. Smoke tracers for R/C planes and choppers, electric igniters, cannon fuse "chemicals," lab acids. Glassware, "how to" books, videos, rocket motor kits; huge catalog $2. Pyrotek, P.O. Box 300, Sweet Valley, PA 18656; (570) 256-3087; website: www.pyrotek.org. [8/00]

**THRUST ALIGNER MOUNT.** Get your craft stable at allowable speeds by finding that ideal angle fast. South Florida Hobbies, 2921 South U.S. 1, Ft. Pierce, FL 34982; (561) 465-9441; website:www.ltkm.com. [3/00]

**NEW BOOK!—HUNDREDS OF PHOTOS,** all classic airplane plans used for Delmar's Gee Bee, etc.! Info, LSASE. Vern Clements, 308 Palo Alto, Caldwell, ID 83605; (208) 459-7608. [3/00]

## HOBBYIST

**WANTED:** Aurora & Cox RTFs, Scientific O/C, Monogram Speedi-Bilts. Dr. Frank Iacobellis, 62 Palisades Rd., Rye, NY 10580; (914) 967-5550. [4/00]

**WANTED:** Classic Glass F4F-1 Wildcat, 1/5-scale kit, any condition. William Hawke, Box 558, Milford, NJ 08848; (908) 996-6000. [3/00]

**WANTED**: Leica camera outfit. Working or not. Virgil Frederiksen, P.O. Box 60781, Boulder City, NV 89006; (702) 293-7800. [5/00]

**MODEL AIRPLANE NEWS**, 1930-1980, "Air Trails," 1935-1952, "Young Men," 1952-1956, "American Modeler," 1957-1967, "American Aircraft Modeler," 1968-1975. $1 for list. George Reith, 3597 Arbutus Dr. N., Cobble Hill, B.C., Canada V0R 1L1. [6/00]

**DOWNSIZING** my personal collection of R/C, FF and rubber airplane kits, along with engines, both ignition and glow. Please send a no. 10 SASE for big list of bargains. Frank Zumer, 801 Quaker Ridge Rd., Mebane, NC 27302; (919) 563-3766. [1/00]

## EVENTS

**ROANOKE VALLEY RADIO CONTROL.** 22nd RC Model Aircraft Swap Shop and Auction. March 11, 2000, Roanoke Civic Center Exhibit Hall, Roanoke, VA. Over 100 tables, huge static contest; cash awards. Concessions, door prizes. 10 a.m. to 3 p.m. Admission $4. Age 12 and under, free. Tables, $8 each. First come, first served. Hobby shops on site. For event information, contact Mike Stubbs, (540) 563-9635. More info on our website: www.rvrc.org. Static info: Russell Stiff, (540) 977-0402. [3/00]

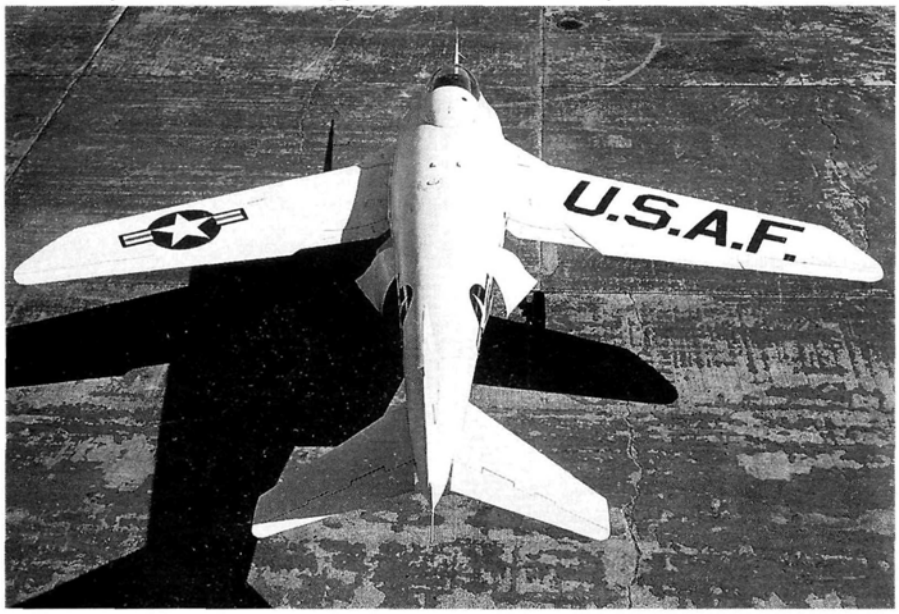
**MAINE RC FLIGHT SHOW.** At KVTC off I-95, Exit 35 in Fairfield, ME, on March 18, 9 a.m. to 3 p.m. RC planes and helicopters, workshops, swap tables, flying demos, auction Sunday PM. Lunch available. Adults—$2, under 15—$1, families—$5. Proceeds to Kennebec Valley Model Aviators for flying-site maintenance. (207) 582-5408, or website: members.mint.net/dfolsom/kvma. [3/00]

**"T.O.C. OF MARYLAND"—2000 FLY-IN COMPETITION.** May 26, 27, 28. Come join us for one of the best combination fly-in/contests in the area. $$ prizes, raffles, hot grilled food, cold drinks. Competitors to fly known, unknown and freestyle programs, with emphasis on freestyle. Call Art Vail, (410) 247-4281 or email artvail@erols.com. [07/00]

# NAME THAT PLANE

## *Can you identify this aircraft?*

**Send your answer** to *Model Airplane News*, **Name that Plane Contest** (state issue in which plane appeared), 100 East Ridge, Ridgefield, CT 06877-4606 USA.




The winner will be chosen four weeks following publication from correct answers received (delivered by U.S. mail) and will receive a free, one-year subscription to *Model Airplane News*. If already a subscriber, the winner will receive a free, one-year extension of his subscription.

Congratulations to Jim Gillie of Coraopolis, PA, for correctly naming our mystery plane from the December 1999 issue: the Fokker F-25 Promoter. The F-25 represents the resilience of the Dutch people during WW II. When the Germans captured the Netherlands, the Fokker company was able to retain its technical staff, so by 1947, they were able to produce the F-25.

The Promoter was a 4-seat, twin-boom, cabin monoplane that was intended for use as a taxi aircraft. It had a wing area of 188 square feet, a wing loading of 15.9 lb./sq. ft. and weighed 2,032 pounds empty. The F-25 was usually powered by a Lycoming O-435 A or a Continental E185 6-cylinder engine. It had retractable tricycle-type landing gear, and its main wheels were equipped with hydraulic brakes. The Promoter could hold a pilot and three passengers, and its nose was hinged to accommodate a front-loaded stretcher. ▼

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# Harness the power of the sun

A few years ago, Sieghard Dienlin, a medical doctor from Mainz, Germany, created a solar-powered, RC model. Of course, solar-powered models are not new today, but Dienlin's "MikroSol" was unique; it was both the world's first solar-powered RC airplane and, at one time, the world's smallest solar-powered RC model.

The basics of solar-powered models are simple: use the sun's energy to power an electric motor. When it comes to facts, however, solar power is more complex. To obtain the maximum available power from the sun (15.5 milliwatts per square inch), you need bright sunshine when the sun is at its apex. Luckily, half of this (7.75 milliwatts per square inch) is a practical mean value.

*Here, the MikroSol is held by its builder, Dr. Sieghard Dienlin.*

The efficiency rating of a solar cell is the percentage of solar energy that is converted to electrical energy under ideal conditions. For practical purposes, solar cells have an efficiency of between 10 and 17 percent, given that the cells are in perfect condition. So, in practice, we can safely count on 7.75 milliwatts per square inch of solar energy by using 12-percent-efficiency polycrystalline cells aboard a typical model. This means that the most that is available to feed the motor of an average 120-inch-span RC glider is 36 watts—not much.

## ADDING LANDING GEAR, WEIGHT AND DRAG

Because of this lack of power, every solar-powered model that I know of has been a glider; compared with airplanes, gliders need less power to stay aloft, and their larger wings provide more area to support the solar cells. Furthermore, you need much more power to take off from the ground than just to stay in flight. So when Dienlin decided to try a solar-powered airplane, he was entirely on his own. He needed to design a model with a better power-to-weight ratio than anything that existed so that he could solve the problem of needing so much power during takeoff.

PHOTOS BY GUY REVEL

*The solar panel in the center of the wing is made of six rows of 3 cells for a nominal 6 volts. The adjustable propeller allows you to plan for the available amount of solar power. Notice how the motor is simply taped onto the end of the two balsa stringers. Simple and light, it's easy to adjust the CG and thrust angle.*

First, he wrote the construction software; he had to optimize every aspect of the plane's design if the model was going to fly at all. Quite early in the process, Dienlin chose to use low power, which meant building a small model. His decision created new difficulties. Dienlin chose to stick with readily available commercial products, and the latest generation of microservos and receivers had not yet been born. He was forced to use larger components, which he powered directly from the solar cells without a buffer battery to save weight. As a fail-safe, Dienlin did incorporate a regulator that switches off the motor when the current drops too low to keep power going to the radio gear. With these parameters, a lengthy process began, and it ended with the MikroSol.

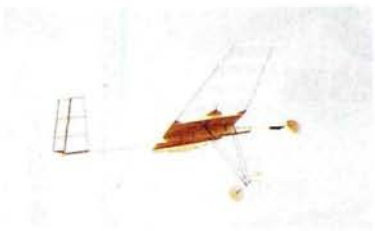
With a 40-inch wingspan, the model was the smallest solar-powered model ever flown, and it gained recognition in the "Guinness Book of World Records."

## SPECIFICATIONS

**Wingspan:** 39.4 in.
**Wing area:** 2.185 sq. ft.
**Wing airfoil:** solar panel area: circle arc, 5.8 percent undercamber; outer wing panels: Goettingen 417a ("curved plate")
**Total weight:** 198.5g (7 oz.)
**Wing loading:** 3.20 oz./sq. ft.
**Solar panel:** 3x6 strings of monocrystalline cells
**Motor:** coreless, rare-earth magnet motor with 15.1:1 in-line, planetary reduction drive
**Prop:** 13.7x14.4 (adjustable)
**Flight speed:** 15.7 fps
**Maximum power from the solar cells:** 8.64W
**Output power at maximum efficiency:** 2.45W
**Power necessary for sustained flight:** about 1W
**Maximum practical power input to the motor:** 5W

## LIGHT BUT STRONG STRUCTURE

The structural design software proved to be worthwhile; the final weight was 0.05 ounce under the computed weight! To achieve this, the MikroSol was built rather like today's indoor, RC slow flyers, but slow flyers had not yet been invented!



*You need only 1 watt to maintain altitude, but more than 2 watts are necessary to take off. The MikroSol is the first-ever purely solar-powered model able to take off from the ground. There is no battery aboard, even for the radio equipment.*

The wing construction uses the curved plate principle and is made in three parts. The central part is rectangular and arcs from front to back. This provides good support for the solar cells and also allows a more uniform exposure to the sun, thus reducing power fluctuation. The outer parts of the wing consist of an outer frame (leading and trailing edges) made of 0.055x0.055-inch graphite, four balsa ribs and a graphite main spar.

## IT FLIES!

Compared with a solar-powered glider, the MikroSol clearly has less aerodynamic efficiency. Another potential hurdle was that the solar cells cover only 28 percent of the wing area. The weight of the solar cells also had to be taken into account. On the MikroSol, the solar cells account for over 20 percent of the plane's total weight (more than all of the RC components!).

The MikroSol first flew in 1995. Other successful flights have taken place regularly since then, even from grass. Sustained flight and climb are extremely easy under most lighting conditions.

Only after a pioneer opens a new path can advancement take place. Although Dienlin and others have built improved solar-powered models since, MikroSol was the inspiration. Perhaps someday, solar power will be as common as batteries are today!

*Editors' note: if you have been experimenting with solar-powered RC, please let us know! Email* Model Airplane News *at man@airage.com, or write to us at 100 East Ridge, Ridgefield, CT 06877-4606 USA.*